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THE

EDINBURGH NEW
PHILOSOPHICAL JOURNAL,

EXHIBITING A VIEW OF THE
PROGRESSIVE DISCOVERIES AND IMPROVEMENTS
IN THE
SCIENCES AND THE ARTS.

CONDUCTED BY

ROBERT JAMESON,

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JANUARY...APRIL 1830.

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The Editor regrets that want of room prevents his noticing the books transmitted until next Number.

The Memoir illustrative of Plate IV. shewing Isogeothermal Lines, and Plate I. of Tripang and Manis, are unavoidably delayed till next Number.

At p. 31, vol. viii. in Major Morrison's paper, is the following statement: "Each vessel being furnished with from 100 to 120 nets, each net being 40 feet in length, which are joined to each other with great facility, and when in the sea present a curtain from 14 to 16 feet in depth;" for which the Major now requests the following may be substituted: "Each vessel, when equipped for the taking of Mackerel, having from 100 to 120 nets, each net being 40 yards in length, which are joined to each other with great facility, and are 18 feet in depth; and for the taking of the Herring, are furnished with from 46 to 60 nets, each being 30 yards in length, and 27 feet in depth."

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THE

EDINBURGH NEW

PHILOSOPHICAL JOURNAL.

Biographical Memoirs of M. HALLÉ[*] *and M.* CORVISART.

By Baron CUVIER.

1. *Biographical Memoir of M.* HALLÉ.

JEAN NOEL HALLÉ, born at Paris, on the 6th January 1754, was of a family, several of whom had become distinguished in the arts[†]. His father, grandfather, and one of his uncles, had been excellent painters, and he had himself applied to drawing with great success. This inclination was naturally favoured by a pretty long residence at Rome with his father, who was director of the French Academy in that city, and, in fact, he studied there, with great assiduity, the monuments of ancient art, and the works of the great artists of the sixteenth century; but, among his father's acquaintance, he at the same time met with two men of science, the French Franciscans, Jacquier and Lesueur, the commentators of Newton, and their conversation opened to his mind another prospect. He was always characterized by a remarkable accuracy of judgment; and the sciences founded on calculation and experiment, offered to this predominant quality of his mind greater attraction than the arts, whose principal source will always be a lively imagination, and a great degree of sensibility. On his return, a domestic example confirmed him in this new pursuit.

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[*] Read at the Royal Institute of France on the 11th June 1827.

[†] Claude Guy Hallé, his grandfather; Noel Hallé, his father; the two Restouts, Jouvenet and La Fosse, his kinsmen. In the number was also the poet La Fosse, the author of Manlius.

Anne Charles Lorry*, one of the most able and most esteemed physicians at the end of the last century, was his maternal uncle. Charmed with the steadiness he discovered in his young friend, he wished to make him his pupil and successor, and soon gained him entirely to medicine. In vain did the protectors of his family hold forth to him brilliant expectations in the finances; nothing could shake his resolution, and, after attending the schools in conformity to the established rules, he took his first degrees in 1776.

The knowledge and clearness of understanding, of which he gave proof in his first exercises, so much distinguished him, that, even before he had in form received the doctor's cap, the founders of the Royal Society of Medicine wished to have him as a companion in their labours;—a precocious honour, which afterwards prevented him from obtaining in the Faculty the title of Regent Doctor. The same affront has been offered to Fourcroy, and other individuals of the highest merit, and from the same motive,—the childish jealousy which led the Faculty to consider the Royal Society as a rival body, and which induced them to vow an implacable hatred against those of their own members, who had consented to let their names be inscribed on the lists of the Society. It will be remembered that this antipathy excited the most ridiculous dissensions among the physicians of the capital, and gave rise to a multitude of odious libels and satires; but what may already give a favourable idea of the gentleness and modesty of M. Hallé's character, as well as of the esteem which these qualities inspired, is, that, in productions, in which men of the highest reputation were not spared, he was less abused than any of his brethren. Keeping, in fact, at a distance from all intrigue, thinking only of the elucidation of his art by whatever aid the sciences could yield to it, but never valuing himself on his successes or his discoveries, and not seeking a popular reputation, he did not offend the vanity, or interfere with the interest, of any one. The study of medicine appeared to him sufficient to occupy a lifetime. Nothing that relates to man as a physical and moral agent, was, in his opinion, unconnected with that noble science; and, in the disinterested feelings towards it which he experienced, he viewed as marks of imbecility all endeavours to gain the estimation of a public, destitute of every thing that would qualify them to judge. He, therefore, remained constantly beside his patients, or in his closet, observing the progress of natural history, chemistry, natural philosophy, and even of political economy and the welfare of all ranks, not less than of physiology and anatomy; but always considering these sciences in their relations to the health of the species, and to that of individuals. It will readily be understood that, after forming to himself so enlarged ideas of medicine, after prescribing to himself so extensive a course of study, he would not be in haste to bring himself forward to public view; and, in fact, excepting his labours at the Society of Medicine, of which he was one of the most industrious members *, and the care which he bestowed on the publication of some writings of his uncle †, he does not seem to have brought forward any work, or to have engaged in any public employment, up to 1795, when he had already passed his fortieth year. Still, while he was thus laboriously improving himself, he had

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* Son of Francis Lorry, and brother of Paul Charles Lorry, both professors of the Faculty of Law.

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* We find, by him, in the Collection of Memoirs of the Royal Society of Medicine, a *Report on the Properties and Effects of the Root of Tooth-wort in the Treatment of Itch*; *Observations on the Phenomena and Variations which the Urine presents in a State of Health*; and on two examinations of dead bodies, which presented phenomena very different from those which the disease seemed to indicate. In the first there was a *scirrhous induration of the stomach*; in the other *a disorganization of the kidneys.* A Memoir, *On the Effects of Camphor given in large Doses, and on the Property which that substance possesses of being a Corrective of Opium*; reflections on secondary fevers, and on the swelling which takes place in small-pox, and several interesting reports on questions submitted to the Society, especially those on police, as it regards the salubrity of towns. He gave, in particular, in 1784, an interesting Report, *On the Nature and Effects of the Mephitic Air of Privies*, when the subject to be examined was the preservative the oculist Janin pretended to have discovered in acetic acid. It was printed separately in 1785.

† In 1784, he published an edition of Lorry's work, entitled, *De Præcipuis Morborum Mutationibus et Conversionibus*; and inserted in the Memoirs of the Royal Society, the observations of the same author, *On the Volatile and Odorous Parts of Medicines, derived from Vegetable and Animal Substances.* At a later period he published an edition of the writings of Bordeu, *On the Glands and Cellular Tissue.*

not lived without benefit to others. His practice had gradually extended, but it was of a singular kind. The easy circumstances which his family had long enjoyed, allowed him to visit, by preference, the sick poor; and this he did assiduously. He aided them by his gifts as much as by his advice; and, ingenious in his charity, concealed his bounty from those by whom, from delicacy, it would not have been accepted. More than one person in distress, on recovering from sickness, found all his expenses paid, and learned, only by importunate inquiry, that every thing had been provided by his physician. His charity gained a great reward, and that which best suited him, the ability still to exercise it at the period when it became most necessary. His father and grandfather had received the ribbon of St Michael, and the ennoblement that always accompanied admission into the order, brought him under the decree of banishment, when the Convention commanded the nobles to leave Paris; but, as the physician of the poor, he was excepted from the rule; and he had then another kind of calamity to relieve. To avert dangers that threatened every one, and, when it was possible, to provide the means of escaping them, became in his eyes duties not less sacred than those of his profession. He penetrated into the prison of Malesherbes, brought him consolation, and received his last farewell. He drew up, at the Lyceum of Arts, the petition soliciting the pardon of Lavoisier. A thousand other services, where the chief condition was secrecy, but which time has in part revealed, occupied him during these two years, which were ages of misery and disgrace.

At length the period arrived when M. Hallé was called to teach, and to advance, by his writings, the art to which he had devoted himself. Fourcroy, entrusted, in 1794 and 1795, with the establishment of a school of medicine, conferred on him the chair of Medical Physics and Health. Not long after, in 1796, when the Institute was formed, he was named a member of the Section of Medicine and Surgery; and, in 1806, Corvisart, fully occupied with his duties near the chief of the government, selected him as his coadjutor in his chair at the College of France, and soon left it to him entirely.

At the Institute, M. Hallé shewed himself not less active than he had been before at the Society of Medicine. Among us he successively treated the greatest questions, of medical science, whether in the reports that were asked of him, or in memoirs in which he explained his own views. His reports on the cowpox are the most important of all. He had upheld it, in some degree, from the time of its introduction, in 1800, and had made known its beneficial effects. In 1812, when these had been established by an experience of some duration, he re-examined the subject, shewed the nature of the exceptions, ascertained their causes, and thus contributed to gain, for that admirable preservative, the confidence that was due to it. He may be regarded as one of its most successful promoters; and France will name him with the Woodvilles and the Rochefoucaults. On this account, Italy, too, owes him especial gratitude. In 1810, he was summoned to extend vaccination in the state of Lucca and in Tuscany; and the public experiments he made there, together with the detailed account he gave of them, forwarded its popularity in that country.

In his lectures at the faculty, M. Hallé viewed medicine as a subject of observation, and dwelt chiefly on those phenomena of the animal economy which can be referred to the known laws of the physical sciences. Physicians have, according to him, too much undervalued the application of these sciences. "The problem of nature," says he, "is a compound of the known and the constant, with the unknown and the variable; and it is a great error to imagine, that, to resolve it, to obtain the value of the unknown, and to fix the shades of the variable, the constant and calculable elements are to be neglected." In this lay the fundamental principle of his course. He did not publish his lectures, but the articles which his pupils extracted from them, for the *Dictionnaire des Sciences Médicales*, will serve to afford some idea of the whole course *. In these articles are seen combined the most enlarged views, a sound judgment, and vast erudition. He always keeps pace with the advance of the sciences, and brings them to his subject in the most ingenious manner.

His erudition was still more eminently displayed in his lectures at the College of France, in which he, as it were, shewed the other side of the picture of medical science, where the economy is viewed in its intimate changes; and physical considerations must almost always be in a great measure renounced. He took for his subject the history of experience in medicine, from the first written monuments of the art, and began his course with an interpretation of the works of Hippocrates, not that he, like so many moderns, by whom they have been scarcely understood, wished to exhibit them pedantically, as collections of infallible oracles, to which nothing could be added, and from which nothing could be taken away; but because he saw in them the first attempts of genius to reduce to rules an order of facts which seem to consist only of exceptions, and because the just and profound views which, notwithstanding some errors, are in these works, in so great number, excite the higher admiration from having been formed at a period when all was unknown beyond what is evident from the immediate observation of diseases.

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* Especially the articles Hygiène, Matière de Hygiene, Alimens, Bains, Percepta, Electricité, Physique Medicale, Afrique, Europe, &c.

An intimate acquaintance with the Greek language, and assiduous study of the philosophers and physicians of antiquity, had suggested to him happy explanations of several obscure passages in the Father of Medicine; and it is much to be regretted that neither his notes, nor those of his auditors, have been found sufficiently ample for the reproduction of this course, at least in its principal articles, as has been done with respect to his course on the study of health.

His design was to follow the progress of observation in all ages, to shew how new facts have led to more correct general principles, and how, on the other hand, science has almost always been retarded by systems. It was a kind of experimental logic, in which he exercised his pupils, and they could have had no better master than he who, from his childhood, had been so distinguished by his sound judgment.

Nothing was wanting in M. Hallé as to knowledge to make him an excellent professor. He was thoroughly versed in all the accessory sciences, and had read in their original language the works of all the great physicians. His own experience was immense, and directed according to the surest method; but it is not generally at the age of forty that one can acquire the facility of elocution indispensable to fix the attention of a numerous auditory. He was not an exception, and there will appear little cause of surprize when we reflect how few there have been among the many eminent individuals successively chosen for our deliberative assemblies. Nevertheless, what was unpleasant in his delivery was redeemed by the profoundness of what he taught; and perhaps it was this very depth, the vast extent of his knowledge, and his multiplied views of objects, that contributed to render his lectures less agreeable to most young people. At first, a student would have only simple and clear rules, and ignorance alone could establish such in medicine. But M. Hallé had also pupils of talent and sagacity, who, not having allowed themselves to be repelled by those circumstances, had reason for congratulation, as they have since expressed on every opportunity. From this select number have come many of the able physicians and distinguished professors who are now the ornament of the Faculty.

M. Hallé's practice also was in some degree affected by this great extent of his knowledge. He knew too much not to have doubts in all cases, and in acute diseases nothing is so vexatious as doubting. The sick, as well as those about them, in general, like physicians whose practice is decided. He was therefore preferred for chronic diseases, where it is not necessary to form an immediate opinion. In this kind of practice he enjoyed the highest reputation; and those who may not choose to rely on the decision of the public, will at least trust to the judgment of a physician, whose right to judge in such a case will not be disputed. Corvisart, in bequeathing to Hallé the portrait of Stoll, wrote that he left this gift to him as the physician whom he most esteemed.

He had above all, in a high degree, the talent of making himself beloved by his patients. Most of them were no longer of the class toward whom he could exercise his charity, but benevolence can assume all forms. Those of whom he took charge became in a manner his children. They saw in him a friend or relation, rather than a physician. When he could not relieve them, he withdrew their mind by agreeable conversation from the depressing thoughts which would have aggravated their disease, and even frequently, when their circumstances were not such that he could have the most natural pretext for shewing his generosity, he was at pains to find others. I do not merely say that he accepted nothing from his professional brethren or his pupils—this were a common case; but he also refused any thing from artists, because, being the son and grandson, the nephew and grandnephew, of well-known painters, he considered himself as one of their family; he received nothing from churchmen, because, if they had only what was necessary for them, they ought not to reduce it—and if they had more, it belonged to the poor. Such reasons he never wanted; one almost required to be privileged, in order to make him accept a recompense; but there was another privilege, the greatest of all in his eyes—that of persons who were unable to recompense him. They were preferred to every other. Returning home one day exhausted with fatigue, he was told that a lady had come to consult him. He sent to request her to apply to some of his brethren. But she dared not, because she had nothing to give. "Oh! in that case," said he, "I have no right to send her away."

This generosity pervaded his whole conduct. He always gave up the whole profits of his works to the young men who had assisted him in collecting materials for them. Being engaged to draw up the new Codex, what was assigned him by the government for this labour, he laid out in completing the Cabinet of the Faculty.

Happy in the good he did, in his fortune, and in his family, M. Hallé seemed moreover to possess the blessing which increases the enjoyment of every other. His health was most robust: only sometimes he was troubled by oppressions arising from an excess of blood, but they were speedily removed by bleeding. A stone, however, suddenly manifested itself in his bladder. At this critical moment, when so many other men would have thought only of themselves, his careful charity remained unaltered. Before having the operation performed, he, with difficulty, visited some poor individuals whom he had maintained, fearing that his long absence would seem to them to proceed from forgetfulness. The operation was successful; but there took place a new congestion in his chest, which, almost suddenly, carried him off on the 11th February 1822. He was only sixty-eight years old; and if the ingenious modes lately devised for the treatment of this cruel disease had been but a little sooner known, he would probably still have been full of activity and life. In the Academy his place was filled by M. Chaussier, and in the College of France by M. Laennec, who has himself been in his youth removed from an art which he had already benefited, and to which he gave promise of still more important discoveries.

2. *Biographical Memoir of* M. CORVISART.

JEAN NICOLAS CORVISART, the associate in office, and constant friend of M. Hallé, was only one year younger. He was born on the 15th February 1745, at Dricourt, a village in the department of the Ardennes, whither his father, an attorney at Paris, had retired, during one of those banishments of the parliament, which the quarrels of that body with the clergy so frequently occasioned during the reign of Louis XV. The duties of an attorney, exercised with talent and probity, yielded sure profits, and would have enriched M. Corvisart, the father; but he is said to have had a passion for painting, without knowing much about it, and, what he gained by defending his clients, he laid out in purchasing bad pictures. Being not more skilled in human nature, he, for a long time, persisted in wishing his son to follow his own profession, and kept him for whole days copying law papers. The young man, who was of a lively and ardent disposition, felt that he had been born for less monotonous occupations. A vague uneasiness disquieted him, his law studies became every day more insupportable, and, perhaps, he would have fallen into great irregularities, had he not, on one of those festive rambles in which he indulged himself, whenever he could escape the eye of his father, entered by chance the lecture-room of Anthony Petit, one of the most eloquent men who have been professors of anatomy and medicine during the eighteenth century. On hearing the impressive discourse of that master, and attending to the majestic development of ideas, whose novelty equalled their extent, the young Corvisart recognised the profession for which he was designed. He longed to study the animal economy, and for this purpose he determined to be a physician. From this moment, dispatching early in the morning the writings which his father had prescribed for him as the work of the day, and requesting the clerks, his companions, to keep his secret, he occupied all the hours that he could spare in attending the lectures of Petit, Louis, Dessault, Vicq d'Azyr, and our estimable fellow member M. Portal. His father at length perceiving his want of assiduity, inquired into the cause of his conduct, and discovered it; but, finding that it was now too late to restrain him, he permitted him to direct his whole attention to his new career. The Academy has possessed many members, whom an irresistible propensity has thus led to escape from the more humble plans which their relations had formed for them, and this perseverance in seeking a profession, in defiance of all obstacles, would undoubtedly be a good test for the choice of one; but how many young persons would be found whom these obstacles would not completely arrest, or who would not enter on courses worse than idleness or irresolution?

The mode of teaching medicine was then very far removed from the extent and regularity which it has since attained. The Faculty of Paris, an ancient body, organized in the middle ages, had scarcely made any change in a system of government that dated back five centuries. With the title of Doctor, all its members received the right of teaching; but they did not become bound to teach. It was only by chance that a sufficient number ever devoted themselves to the task of insuring a regular course of lectures to youth. Some professorships were, indeed, instituted in the Faculty, but their fee was wretchedly small. The professors were changed every two years, the younger doctors being made to occupy these chairs in regular succession. They hastened to get through the drudgery, in order to acquire the title of Regent Doctor, and, entering on office without the preparation of study, they retired without having formed themselves by practice. Besides, there were no public lectures at the beds of the sick. In order to see a few patients, the students accompanied the elder physicians in their visits; afterwards, when these elder physicians were unwell, or too much busied with practice, they acted for them, and thus they continued, till at length they, too, slowly attained their professional rank.

M. Corvisart, to whose ardent genius this tedious progress could not fail to be singularly disagreeable, had yet the patience to conform himself to it in every point; but he chose his masters as a man destined to become one himself. Desbois de Rochefort, chief physician of La Charité, and Dessault, chief surgeon of the Hôtel-Dieu, in the healing art two of the most eminent men of their time, became his principal patrons. It is well known that Desbois de Rochefort had the great merit of first shewing the example of regularly delivering clinical lectures in his hospital. Under his guidance, M. Corvisart for several years occupied himself in the observation of diseases, and in the opening of bodies. For this task he had a real passion. The melancholy spectacles which it displays, the dangers to which it is liable, neither repelled nor discouraged him. A puncture which he had received while dissecting, brought him almost to the point of death, and he is said to have escaped only through the assiduous care which Dessault lavished on him. He also, at a very early period, delivered in his own house lectures—not on medicine properly so called (for he did not think that so young a doctor could conscientiously do so), but on anatomy and physiology; and his perspicuity and ardour attracted a crowd of hearers. Nothing more was wanting to him, but to be himself at the head of an hospital, where he could freely pursue the views which his growing experience suggested to him. The first masters of the art judged him worthy of one, and he thought himself on the point of attaining this object of his wishes, when a cause the most trifling in the world kept him back for several years. The customs and dress of physicians were scarcely less antique than the system of government of the Faculty. If Molière had made them lay aside the gown and the pointed cap, they had at least preserved the full-bottomed wig, which no one else any longer wore, and it was on entering into office that they had to muffle themselves in it. It is affirmed that M. Corvisart and M. Hallé were the first who gave the scandal of not assuming it, and that this levity, as it was called, proved very hurtful to them. It is at least certain, that, on the occasion of which we speak, it was the cause of M. Corvisart's disappointment, and that through the person from whom he had least reason to expect it. A celebrated lady, whose husband was the cause, at least the incidental cause, of the greatest innovations that have taken place in France since the establishment of the monarchy, had just founded an hospital, and M. Corvisart ardently wished to obtain the charge of it; but he presented himself in his natural hair, and this innovation she dared not take upon herself to countenance. At the first word she declared to him that her hospital should never have a physician without a wig, and that it was for him to choose between that head-dress and his exclusion. He preferred keeping his hair.

By a happy contrast, and when probably he had not greater expectations, it was a monk who, on another occasion, did him more justice. On the death of Desbois de Rochefort, which happened in 1788, the superior of the ecclesiastics attached to the Hôpital de la Charité, a man held in great estimation for his wisdom and his zeal in favour of the sick, and who had been daily witness of M. Corvisart's assiduous cares, employed his credit in getting him attached to that house, and succeeded in the endeavour. From this time, M. Corvisart, continuing the clinical instructions of his predecessor, saw all the young physicians attend his lectures. He excited admiration by possessing in an eminent degree the talent of discovering from the first moment the nature of diseases, and of foreseeing their progress and event. His fellow-practitioners were not slow in doing him full justice, and he was already considered as one of the first masters in the capital, when, in 1795, Fourcroy procured a chair to be founded for him in the New School of Medicine. Two years after, in 1797, he was appointed to the professorship of medicine in the College of France, and there found himself in the capacity of teaching the art in a theoretical point of view, as he had hitherto shewn it practically. The same pupils who heard him in the one school explain the general principles, went to see in the other their happy application, and in all things found him correct, ardent, and obliging in the highest degree. In every thing, his pleasing eloquence, his lively temper, his sure and quick tact, excited the highest admiration. If any one had a feeling of repugnance to an art condemned to witness such melancholy scenes, he had only to hear M. Corvisart for some time to become an enthusiast in it.

Already all Europe rung with his fame, when, in 1802, he was raised to the highest post in his profession, and yet this elevation was not alone the result of his renown. Every one remembers that it was put to the proof, and that, on being called into consultation respecting an affection of the chest, which threatened the chief of the government, he first discovered its cause, and effected its removal.

His success, however, had not inspired him with an implicit faith in medicine. It is even said that the mistakes which, notwithstanding his great sagacity, sometimes happened to him, gave him the greatest vexation, and made him, in those moments of discouragement, speak ill of his art; nor did he, like those works in which it was pretended to assign precise characters, and a regular progress to each disease, and from which young persons might form of medicine an idea similar to that afforded by the physical sciences, properly so called, and still less those in which it is presented in a deceitful simplicity, under the idea of referring diseases and remedies to a small number of forms,—it was not thus that he viewed it. Organized beings have their certain laws, each of them conforms to the type of its species; but the disorders which introduce themselves into their organization, are subject to endless combinations; each day this may assume a different complication; and it is from the whole symptoms of each moment, taken together, that they are to be judged of, and combated. Nor did any one pay more attention to these sensible signs. The best physician, according to him, was he who had succeeded in giving to his senses the greatest delicacy. He did not attend solely to the pains felt by the patient, to the variations of his pulse, or of his respiration. A painter could not have better distinguished the shades of colour, nor a musician all the qualities of sounds. The slightest alterations of the complexion, of the colour of the eyes and lips, the different intonations of the voice, the smallest differences in the muscles of the face, fixed his attention. Even the variations of the breath and transpiration were carefully measured by him, and, in the judgment which he formed, nothing of all this was a matter of indifference. The innumerable openings of bodies which he had made, had enabled him to remark the correspondence of the slightest external appearances with the internal lesions. He is said to have distinguished, at the distance of several beds, the disease of an individual that had just come to the hospital; and, with respect to the disorganizations of the heart, and great vessels in particular, he had attained to a truly wonderful accuracy of divination. His decisions were irrevocable, like those of destiny. Not only did he predict the fate that awaited each patient, and the period at which the catastrophe was to happen, but he gave, beforehand, the measure of the swellings, dilatations, and contractions of all the parts; and the opening of the bodies' scarcely ever refuted his announcements. The most experienced, it is said, were utterly astonished by them.

His two principal works, the Treatise on the Diseases of the Heart *, and the Commentary on Auenbrugger, are celebrated testimonies of the manner and genius of M. Corvisart. In the first, the inflammations of the pericardium, the dropsies which fill its cavity, the thickening and attenuation of the walls either of the heart in general, or of each of its cavities, the hardening of its tissue, its ossification, its conversion into fat, the contraction of its orifices, its tumours, its inflammations, and its ruptures, are presented, together with their melancholy symptoms, and their fatal results, with an order and clearness that nothing in medicine can surpass. This book so occupied the minds of the young physicians who were eager for instruction, and their imagination was so powerfully struck by it, that, for some time, it is said, they saw nothing but diseases of the heart, as at other times they have seen every where gravel, bile, asthenia, or inflammations. The effect which it would have on the sick would be still more cruel. His epigraph itself, *Hæret lateri lethalis arundo*, tells how disheartening the reading of it is; but medical books are not made for those who are not physicians; and it is well that those who are so, should know positively when nothing remains for them to do. This unhappy certainty prevents them at least from tormenting their patients with useless remedies.

In the Commentary on Auenbrugger, it is the diseases of the chest, the fluids which fill its cavity, the tumours which obstruct the bronchia, or the cellules of the lungs, that he teaches us to distinguish, by the different sounds which the walls of that cavity emit when struck. The form given to this work ought to be remarked as the proof of a noble generosity. In it M. Corvisart sacrificed his fame, a kind of property of which men are less disposed to be lavish than of any other, to a delicate feeling of justice towards an unknown individual, and one who had been long dead. He had already, from the suggestions of his own mind, made most of the experiments contained in this commentary, and had intended to collect them in a single work, when there fell into his hands a dissertation, published in 1763, by a physician of Vienna, translated in 1770 by a French physician, and yet almost entirely forgotten, in which he found part of what he had observed. *I could have sacrificed Avenbrugger's name*, says he, *to my own vanity, but I did not choose to do so: it is his beautiful and legitimate discovery that I wish to revive.*

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* Essay on the Diseases and Organic Lesions of the Heart and Large Vessels, extracted from the Clinical Lectures of M. Corvisart, and published under his inspection by M. E. Horeau, 1 vol. 8vo. Paris, 1806, 2d edition.

These words of themselves describe a character. No one, in fact, was more free, more open, more unassuming; nor could any person be less occupied with himself. Placed so near the man whose word was all-powerful, and at the time when so many prerogatives were brought back by little and little, which were of advantage only to those who were decorated with them, how easily could he have obtained for himself the restoration of the ancient privileges conceded to first physicians, so lucrative, but so useless, it may even be said so hurtful, sometimes to the real progress of medicine. But he was sensible that at the height which the sciences had reached, the exclusive influence of one individual, were he the most skilful in his profession, could only restrain their flight. So far was he from wishing to gain any pre-eminence, that he did not take a higher rank in his hospital than was due to him in point of seniority. On the other hand, contrary to the example of those zealous persons who think they shine so much the more when they are surrounded only by obscure individuals, he appointed to the different situations in the medical house the physicians who enjoyed most reputation in the city. There were in the number some who had written and spoken against him; for even this was not to him a motive of hesitation. Those whose memory alone remained to be honoured, the Bichats and the Dessaults, obtained, at his solicitation, monuments, the only mark which he wished to leave of the favour which he enjoyed. I forget he has given another,—in founding, at his own expense, in the Faculty, prizes for the young persons who distinguish themselves by good clinical observations. It has been remarked, that many men, on attaining distinction, have remembered the obstacles which poverty opposed to them in their early years, and, by a very natural feeling, have sought to render less difficult the progress of some of their successors. M. Corvisart was led to this the more willingly, that, to his enthusiasm for his profession, he joined a true friendship for those who were possessed of the same feeling. He was jealous of none of his fellow practitioners, and always did them whatever services lay in his power. His greatest pleasure was to see himself surrounded by young physicians who exhibited talent, and it was not with his advice, and with his lectures alone, that he encouraged them; he made them partake the enjoyments of his fortune, and the diversions which a secret inclination to melancholy appear to have rendered necessary to him. It is said, that, when he had performed the duties of his profession, if he did not give himself up to the amusements of gay and enlivening society, he fell into depression of spirits, and painful melancholy; that in him the active and busy physician of the morning, became in the evening a man of pleasure, who would not permit either his art or his patients to be spoken of,—a disposition unfortunately too common among men of ardent genius, and which greatly diminished the services which M. Corvisart might have rendered to science. Without hurting his zeal for teaching, which identified itself with his passion for his art, it made him a rather negligent academician, and an unproductive author. After having keenly desired to be admitted among us, he scarcely ever assisted at our meetings. His treatise on the diseases of the heart, although his own in the ideas and in all that forms the essence of a work, did not come from his pen, but was drawn up by one of his pupils, M. Horeau; and if it may be regretted that any one should require such diversions, he was a fortunate man, who, amid all his amusements, was capable of leaving such a monument.

It is asked, and the question naturally suggests itself with respect to many others, if, on the frequent occasions when professional duty brought him near a man whose power was unlimited*, he had not some opportunities of giving him advice that might have been useful to himself, and have perhaps spared some of the blood of Europe? It is certain that he did not allow himself to sink so much as many personages who appeared externally in a higher position, and that whenever, for example, the master shewed a disposition to banter him on his profession, a smart reply quickly checked the attempt; but it is also certain, that he never conversed about any thing of general interest. On matters of indifference, every familiarity was allowed him; but a cold look, or a harsh word, stopped him the moment he tried to break this circle. He himself related, that, at the period of a birth, which, coming especially from such a marriage, seemed calculated to satisfy the most ambitious hopes, he permitted himself to ask if any thing more could be desired. *Toujours Champenois Docteur!* was the only reply he received, and the speaker turned his back.

M. Corvisart had applied on himself his inexorable talent of foresight, and had obtained from it but a very melancholy augury. His conformation, and the instance of his father, had given him a presentiment of the apoplexy which threatened him, and which did not fail to come on nearly at the time that he had foretold it. This cruel disease at first only affected his motions; his judgment remained sound, and the first use which he made of it was to renounce all exercise of his art, and give himself up entirely to repose. But this precaution delayed only for a very short time an attack which proved fatal. He died on the 18th September 1821, leaving no family.

His place in the Academy of Sciences has been filled up by M. Magendie, and his chair in the College of France had for several years been occupied by M. Hallé.

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* Bonaparte.

Notice regarding the Salt Lake Inder, in Asiatic Russia. Communicated by Lieutenant J. E. Alexander, 16th Lancers, K. L. S. M. R. A. S. Corres. Mem. S. A. E., &c.

THE country and desert of the Kirguis, in which is the Lake Inder, is very imperfectly known, owing to the great danger attending travelling in that region, from the Nomade tribes of Kirguis and Tartars, who move about like the Arabs, plundering caravans and travellers. A German botanist of the name of John C. G. Herrmann, who, some years ago, left St Petersburgh for the south of Russia, and has never since been heard of, once visited this lake: from some memoranda of his*, and other sources, I have been able to collect what follows.

On descending the River Ural, formerly known by the name of the Jaik, and in the direction of the Military Cordon, there is situated the advanced post called Gorski or Inders-Koigor, about 300 versts distant from the town Uralsk, capital of the Ural Cossacks. The Gorski post is singularly situated on the right bank of the river, and faces the Lake Inder, which contains such an abundant supply of salt of the first quality, that it would suffice for the consumption of all the Russias, if the difficulties attending the carriage of it were not almost insurmountable; and this is the reason why the preference is given to the salt of the Lake Geldon or Elton, where those difficulties do not exist, though the salt of this lake is very inferior to that of Lake Inder.

This great magazine of salt is situated about 26 versts in the Kirguis desert, in lat. 48° 30′, and long. 69°. It is elevated above the level of the river Ural, and the shores are surrounded by low hills of sandstone, on which there is scanty vegetation, and a few shrubs. The lake, which lies as in a basin among the hills, is twenty versts in length, and nine broad, and is an oval in appearance. The bottom is an immense stratum of salt, covered to an inconsiderable depth with water. The saline stratum has several orifices in it: down one of these (sixteen inches in circumference), a plum-line was lowered, and no bottom was found, with 180 feet of cord. The water impregnated with salt, which rests on the solid stratum, is so shallow that one can traverse the lake in every direction, either on foot or horseback. At the end of summer, the water is all dried up, and the lake is covered with salt as white as snow recently fallen, and of great purity.

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* My friend Mr Prescott of St Petersburgh, well known to the botanical world, purchased some time ago the Herbarium and MSS. of Hermann.

Those who live on the north side of the Cordon, use the salt of this lake; but those who are more to the eastward, use the salt of the lake in the Russian territory, being afraid to venture into the desert to supply themselves with the superior salt of Inder. The lake has several salt springs in it, and to the distance of ten or twelve versts round it, the water is so impregnated with salt, that neither man nor beast is able to swallow it.

The plants and insects that are found here are also peculiar to the place; but I have not been able to collect much information regarding them, for it seems to be impossible to spend that time in the vicinity of the lake, which is requisite for a thorough investigation of it. The disposition of the Kirguis is so hostile, and their hordes are so numerous, that, notwithstanding Herrmann was accompanied with a numerous escort, and field-pieces, it was impossible to make the tour of the lake. Indeed, 2000 Kirguis *kebeeks* or tents were pitched on the banks of the river Kara Kiel, which runs parallel with the lake, at a few versts' distance: these they could not pass, and consequently only saw the centre of the lake, the salt of which, from the examination of specimens, was crystallized in cubes.

From Mr Prescott, I learn that the vegetation of the lake bears a strong resemblance to that of the Caspian Sea, and of the salt and sandy steppes around it. The low bushes are principally of the tribes of *Polygoneæ* and *Salsoleæ*, numerous species of *Salsola, Salicornia, Calligonum Palasia, Tamarix* and *Atraphaxis*. There are, however, some, as I said before, peculiar to the place; such as *Leontia vesicaria, Molucella tuberosa*, and *Megacarpæa laciniata*, all curious in their structure. For the short period during which it was possible to visit the lake, the most interesting herbaceous plants observed were, numerous *Cruciferæ, Ranunculi, Allia, Amaryllis tatarica, Astragali, Carex physodes*, and a new genus near *Frittillaria*, called *Rhi-*

nopetalum by Dr Fischer, from its curious spur-like appendage to the upper sepal. There can be little doubt, if circumstances would admit of a thorough investigation of the shores of the lake at any future period, that great botanical treasures might be expected.

An officer in the Russian service told me that he was at the lake in the month of May, and saw large herds of antelopes on the sand hills, likewise quantities of snipes near the salt pools; and swans, cranes, ducks, and flamingos, which seemed to resort to the lake to drink the water. He also said that he had a servant who was bitten there by the minute worm of the marshes, called the Siberian Plague, which can be no other than the *Furia infernalis*, of the existence of which some naturalists doubt. Ivan, the servant, had been out all day, and in the evening, when he returned to the tents, his master observed that there was a red spot on his cheek, and that it was slightly swelled. His master knew what had happened, and told him, that, if he did not take care, he would be dead in three days; and that the only remedy was to perforate the skin of the cheek diagonally, and in different directions, with an awl, and to rub snuff into the wounds. Now, Ivan was a Kirzack, or Russian of the old faith, who cross themselves in a different manner from the others—have a number of superstitious rites and ceremonies—have no priests, the laity officiating by turns, and each man carries with him his own plate, knife and spoon, as they will not eat out of the vessel of another. Among other things, they will not touch snuff, consequently Ivan made up his mind to die; and next morning his head was swelled to an immense size. But his master did not wish to loose him, so, pretending to prepare some herbs for him, he got an awl, and pierced his cheek in a slanting direction, under the skin, and rubbed in snuff, and repeated the operation; and though the servant was in a high fever for two days, yet at last the swelling and fever subsided together, and he recovered. Children frequently die from the bite of this worm, which, in Siberia, is greatly dreaded.

ST PETERSBURGH,
30*th June* 1829.

On the Discovery of a new species of Pterodactyle, and of Fossil Ink and Pens, in the Lias at Lyme Regis; also of Coprolites or Fossil Fæces in the Lias at Lyme Regis, and Westbury-on-Severn, and elsewhere, in formations of all ages, from the Carboniferous Limestone to the Diluvium. By the Rev. W. Buckland, D. D. F. R. S. F. L. S. F. G. S. and Professor of Geology and Mineralogy in the University of Oxford.

In the course of the last session of the Geological Society of London, several papers on the above subjects were communicated by Professor Buckland, the substance of which is collected in the following notice; the papers themselves being in course of publication in the Transactions of the Society.

I. *Pterodactyle.*—This specimen of pterodactyle was discovered in December last, by Miss Mary Anning, and belongs to a new species of that extinct genus, hitherto recognised only in the lithographic Jura-limestone of Sollenhofen, which the author considers as nearly coeval with the English chalk. The head is wanting, but the rest of the skeleton, though dislocated, is nearly entire; and the length of the claws so much exceeds that of the claws of the Pterodactylus longirostris and brevirostris (of which the only two known specimens are minutely described by Cuvier), as to shew that it belongs to another species, for which the name of Pterodactylus macronyx is proposed; it is about the size of a common crow, and a drawing of this fossil by Mr Clift accompanies the paper. The author had for some time past conjectured, that certain small bones found in the lias at Lyme Regis, and referred to birds, belong rather to the genus Pterodactyle. This conjecture is now verified. It was also suggested to him, in 1823, by Mr J. S. Miller of Bristol, that the bones in the Stonesfield-slate, which have been usually considered as derived from birds, ought to be attributed to this extraordinary family of flying reptiles: Dr Buckland is now inclined to adopt this opinion, and is disposed to think still further, that the coleopterous insects, whose elytra occur in the Stonesfield-slate, may have formed the food of the insectivorous pterodactyles. He conceives also, that many of the bones from Tilgate Forest, hitherto referred to birds, may belong to this extinct family of anomalous reptiles: and, from their presence in these various localities, he infers that the genus Pterodactyle existed throughout the entire period of the deposition of the great Jura-limestone formation, from the lias to the chalk inclusive, expressing doubts as to the occurrence of any remains of birds, before the commencement of the tertiary strata.

II. *Fossil Ink and Pens.*—An indurated black animal substance, like that in the ink-bag of the cuttle-fish, occurs in the lias at Lyme Regis; and a drawing made with this fossil pigment, four years ago, was pronounced by an eminent artist to have been tinted with sepia. It is nearly of the colour and consistence of jet, and very fragile, with a bright splintery fracture; its powder is brown, like that of a painter's sepia; it occurs in single masses, nearly of the shape and size of a small gall-bladder, broadest at the base, and gradually contracted towards the neck. These ink-bags are attached to the remains of two unknown molluscæ; one apparently an orthoceratite, the other a loligo.

1. In the first of these the ink-bag is surrounded by a thin envelope of brilliant nacre, which formed the lining of a shell, having the external shape and wavy surface of an orthoceratite. In the most perfect specimen the author possesses, the upper chamber is nearly five inches deep, and two inches in diameter; within it was lodged the ink-bag and other soft parts of the animal's body; the bottom of the cavity terminates in a series of circular transverse plates, like the chambered alveolus of a belemnite, packed close on each other like a pile of watch-glasses. The uppermost of these plates is in immediate contact with the base of the ink-bag, the rest diminish rapidly in size, and nearly in the same proportion in which the plates diminish in the belemnite; beyond the lowest of them, no elongation of the shell, nor traces of any sheath, have yet been found; the external shell, in most specimens, has entirely perished, but its nacre is always preserved, and is usually compressed to a thin flat sack

surrounding the ink-bag; the author proposes to designate this fossil by the name of Orthoceras-belemnitoeides.

2. In the newly discovered Loligo from the lias, the ink-bags are in contact with the horny remains of a pen somewhat like that of the Loligo vulgaris, but having a thin plate of cellular spongy carbonate of lime immediately beneath, and adhering to the horny plate of the pen; for this species, the author proposes the name of Loligo antiqua.

III. *Coprolites or Fossil Fæces.*—Dr Buckland has ascertained from an extensive series of specimens, that the fossils locally called Bezoar stones, which abound at Lyme Regis, in the same beds of lias with the bones of ichthyosaurus, are the fæces of this animal. In size and form they resemble elongated pebbles or potatoes, varying generally from two to four inches in length, and from one to two inches in diameter; some few are larger, others smaller. Their colour is dark grey, their substance like indurated clay, and of a compact earthy texture; and Dr Prout has ascertained, that their chemical analysis approaches to that of Album græcum. Bones and scales of fishes occur abundantly in these fæcal bodies; the scales are referable to the Dapedium politum, and other fishes that occur in the lias; the bones are those of fishes, and also of small ichthyosauri. The interior of these coprolites is arranged in a spiral fold, coiled round a central axis; their exterior also bears impressions apparently received from the action of the intestines of the living animals. In many of the entire skeletons of ichthyosauri found in the lias, compressed coprolites are seen within the ribs and near the pelvis; these must have been included within the animal's body at the moment of its death. Dr Buckland has ascertained further, that the circular bodies, resembling the bony rings of the suckers of cuttle-fish, occur in the coprolites mixed with the scales and bones above mentioned. All these bodies appear to have passed undigested through the intestines of the ichthyosauri; and Dr Prout has also found that the black varieties of coprolite owe their colour to matter of the same nature with the fossil ink in the lias; hence, it follows, that the ichthyosauri fed upon the sepiæ of these ancient seas as well as on fishes, and on the young of their own species. The author has also ascertained, by the assistance of Mr Miller and Dr Prout, that the small round black bodies, having a polished surface, and resembling pebbles of jet, which occur mixed with bones in the lowest strata of the lias on the banks of the Severn, near Bristol, are varieties of coprolite: they appear to be coextensive with this bone-bed, and occur at many and very distant localities. He has also received from Mr Miller similar small black fæcal balls from a calcareous bed, nearly at the bottom of the carboniferous limestone at Bristol. This bed abounds with teeth of sharks, and with bones, teeth, and spines of other fishes; and the coprolites in it may have been derived from small reptiles, or from fishes; and, in the case of the lias bone-bed, from the molluscous inhabitants of fossil nautili, ammonites and belemnites. In a collection at Lyme Regis, there is a fossil fish from the lias, which has an ichthyo-coprus within its body; and, in Mr Mantell's collection of fishes, from the chalk near Lewis, there are two specimens of the Amia Lewesiensis, each containing a coprolite within its scales and ribs: to these the author proposes to assign the name of Amia-coprus. He also proposes to designate the so-called bezoars, which are derived from the ichthyosauri, by the name of Ichthyosauro-coprus; and the Album græcum of the fossil hyænas by the name of Hyæna-coprus. Dr Buckland has also recently ascertained the existence of coprolites in the Oxford oolite near Weymouth, and in the Kimmeridge clay near Oxford. About four years ago he found, in Mr Mantell's collection of bones of various reptiles from the Hastings sandstone of Tilgate Forest, balls of fæcal matter, differing in shape from those of the ichthyosaurus. To some of these reptiles he refers the coprolites in question; and conjectures that Sauro-copri will be found, wherever the remains of saurians are abundant. Dr Buckland has also coprolites found by Mr Richardson, in the green-sand of Wiltshire, and by Miss Anning in green-sand near Lyme.

As soon as Dr Buckland had established, by a series of specimens, that the balls of ichthyosauro-coprus were composed of a lamina of earthy phosphate of lime, wrapped spirally round itself, it occurred to him that this structure is so similar to that of the supposed fir-cones or iuli in the chalk and chalk-marl, that he immediately conjectured these so long misnamed iuli, to be also of fæcal origin. On examination, he found many of them to contain scales of fishes, and to bear on their surface impressions derived from the intestines in which they were formed; and Dr Prout's analysis proves their composition to be the same as that of other coprolites. The spiral intestines of the modern shark, ray, and dog-fish, afford an analogy that may explain the origin of their spiral structure, as well as that of the spiral structure of many coprolites at Lime Regis; and the teeth and palates of sharks, and other cartilaginous fishes, that abound in the same chalk-marl with them, render it probable that the supposed iuli have been derived from some of these animals. Until this point can be fully established, it is proposed to designate them by the name of Iuloideo-coprus. There are several fine specimens of this Iuloideo-coprus from the quarries of Maestricht, in the collection of Colonel Houlton of Farley Castle, near Bath. Dr Buckland has also discovered a coprolite among fossils he possesses from the London clay; and has found two other varieties of the same substance in a collection lately made at Aix, in Provence, by Mr Murchison and Mr Lyell. One of these coprolites is in the shale of the fresh-water coal formation at Fuveau; the other in the insectiferous marl-bed above the gypsum at Aix. Dr Buckland concludes that he has established, generally, the curious fact, that, in formations of all ages, from the carboniferous limestone to the diluvium, the fæces of terrestrial and aquatic carnivorous animals have been preserved. The examples he produces from the carboniferous limestone, the lias, the Hastings sandstone, the green-sand, the chalk-marl and chalk. The Maestricht rock, the London clay, the fresh-water deposites at Aix, and the diluvium in caverns, are taken respectively from the several great periods into which geological formations are divided. They are important, as shewing a continued tranquil condition of the earth's surface to have prevailed for some time, whereever they occur abundantly.

A letter from Dr Prout to Professor Buckland, was read on the 3d of April 1829, stating that he has made an analysis of the coprolites from Lyme Regis, and Westbury-on-Severn, and found the composition of all of them to be very similar, viz. phosphate of lime, and carbonate of lime, together with minute variable proportions of iron, sulphur, and carbonaceous matter. The relative proportions of the principal ingredients, appear to differ somewhat in different specimens, and even in different parts of the same specimen; hence no formal analysis has been attempted: but the phosphate of lime may, perhaps, be estimated to constitute from about one-half to three-fourths of the whole mass.

Dr Prout conceives this composition to prove that the basis of these coprolites is bone; and that Professor Buckland's opinion, that they are of fæcal origin, or of the nature of Album græcum, offers a very satisfactory explanation of their occurrence, and accounts at once for their chemical composition, their external form, and their mechanical structure. Dr Prout has also examined all the most important specimens of coprolite that are mentioned in Dr Buckland's papers, and concurs with him in believing them to be all derived from digested bones.

The Guano, or dung of sea-birds, on the coast of Peru, and islands adjacent, affords an analogous example of the preservation of recent fæces, in beds and masses, which are stated to be sometimes fifty or sixty feet in thickness. This Guano, however, differs chemically from any fossil coprolites that have been examined by Dr Prout, and contains much urinary matter.

Dr Buckland proposes to add this Guano to his series of coprolites by the name of Ornitho-coprus.

On the Chemical Constitution and Temperature of Springs, in reference to the Rock Formations in their Vicinity. By Dr and Prof. GUSTAVUS BISCHOFF*.

THE facts stated in our work quoted below, shew an evident connexion between the volcanic ridge of the Westerwald, Taunus, &c. and the numerous springs found there. Our mineral waters at Geilnan, Fachingen, and Selters, as well as several others in these mountains, experimented on by different chemists, are remarkably distinguished by their containing different salts of soda, such as the carbonate, sulphate, and muriate. What is more natural than to inquire, Are these salts of soda also found in other springs, which rise in other volcanic ridges? Berzelius has already preceded us in the exposition and answering of this question.

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* Dr Gustavus Bischoff, uber die Vulkanischen Mineral quellen Deutschlands und Frankreichs, 1 vol. 8vo. Bonn. 1826.

This excellent chemist says*, that, as the atmospheric water, which enters pure into the earth, reissues charged with the carbonate, sulphate, and muriate of soda, these salts must be a universal and common product of volcanic activity. But who, he continues, if he considers the immense volcanic masses which surround Carlsbad, from Engelhaus to Schlackenwerth, will hesitate to apply this conclusion to the springs of Carlsbad? He then shews the great similarity between a great part of the north of Bohemia, and particularly where the mineral waters are most abundant, and the provinces of Auvergne and Vivarais, in France. He says, that even here, between the lava-streams, which have flowed from the extinguished volcanoes surrounding the Puy de Dome in Auvergne, in all directions, into the plains of Limagnes, a greater or less number of warm springs issue, which are rich in the carbonate, sulphate, and muriate of soda, and even deposite carbonate of lime. Berzelius mentions several of these springs, which bear great resemblance to Carlsbad, and observes, that whenever we recede from the volcanic district, no spring of that peculiar composition is to be met with; but they reappear when we reach Cantal, which is also volcanic; and that, finally, the alkaline natron springs appear in Vivarais (department of Ardeche). This chemist, in conclusion, remarks, that he is far from maintaining, that all natron springs, saturated with carbonic acid, with or without a proportion of iron, must necessarily have the same origin: to be justified in maintaining such a position, researches would be required, which have not yet been made, and which could be effected by no single naturalist. I agree with Berzelius in thinking, that a more exact investigation of the environs of such springs, will render more apparent to us their connexion with ancient volcanic appearances; and I have endeavoured to prosecute the inquiry, as far as was possible, from the present state of our knowledge of the geognostical relations of those countries, with the chemical constitution of whose springs we are acquainted. What has already been done in these districts permits of an extent being given to these researches, which could scarcely have been expected, and yet many observations may easily have escaped me. But I flatter myself, that what follows will answer the above question in the affirmative in a general way.

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* Researches on the Mineral Waters of Carlsbad, Töplitz, and Konigswart, in Bohemia, by J. Berzelius. From the Transactions of the Royal Academy of Sciences of Sweden for 1822; translated by Gustavus Rose, with some illustrations by Gilbert, in his Annalen der Physik, vol. lxxiv. p. 113 and 276.

As this is the most proper place, I will first shortly treat of those inquiries and considerations of other naturalists, which have any relation to the subject.

The older naturalists almost unanimously attributed the heat of warm springs to subterranean fire, or, at least, to the same causes which produce this fire. On the erroneous view, that they all contained sulphuretted hydrogen gas *, was founded the supposition, that the water of these springs previously flowed over beds of iron-pyrites, and, by their action on them, obtained both their sulphuretted hydrogen gas and their elevated temperature.

Becher † assumed, in reference to Carlsbad, that water, holding common salt in solution, flowed over a burning bed of pyrites, the sulphuric acid of which changed the muriate into the sulphate of soda. Berzelius has demonstrated ‡ the untenable nature of this assumption, which does not once refer to the origin of the carbonate of soda.

Klaproth §, who at once saw the difficulties of Becher's hypothesis, believed, that the Carlsbad waters were heated by a large bed of coal, set on fire by iron-pyrites; and that iron-pyrites, coal, limestone, and salt-springs, were the raw materials out of which nature elaborated these hot mineral waters. But Leopold von Buch ||, on geognostical, and Berzelius ¶, on chemical grounds, have respectively shewn the untenableness of this proposition.

The latter observes, that however easy it is to be convinced

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* Parrot, Grundriss der Physik der Erde und Geologie. Riga and Leipzig, 1815, p. 315.

† New Treatises on Carlsbad, by David Becher, 2d edit. 1789, p. 20.

‡ Swedish Academy for 1822, p. 17?. § His Beiträge, vol. i. 346.

|| Bergmannische's Journal for the year 1792, p. 383, especially p. 412.

¶ Swedish Academy, p. 177.

that these explanations are insufficient, yet it is difficult to substitute a more probable one in their place. We know, says Berzelius, that near many active volcanoes hot springs pour forth immense quantities of water. We may conclude, from their temperature, that their channels pass near the centre of volcanic action, from which they acquire their heat. Their water, besides, holds in solution many ingredients which are foreign to that of ordinary springs; for instance, the above-mentioned salts of soda, and a much greater quantity of silica than is found in ordinary springs. The hot springs of Iceland are a well known example of this. The circumstance of these waters, in some places, containing sulphuretted alkali, he views, as shewing, that, on the spot where the water dissolved this salt, the operation of the volcano had not extended far enough, to oxidize all the oxidizable substances, or had withdrawn itself before its action was completed. He now makes use of extinguished volcanoes, in which the crater has been closed by congealed lava, filled with ashes, sand, and rubbish, and the glowing focus has gradually cooled. But there is found, as he correctly remarks, not the smallest loss of temperature by radiation, but the warmth can only escape through the mass of the surrounding rocks, and as these are known to be the worst conductors of heat, thousands of years might be required ere they reached the mean temperature of the earth. But the springs existing near a volcano continue, after its extinction, to flow through their former canals only so long as the water existing is supplied from the atmosphere, and must issue forth to the surface as formerly, warm and saliferous, as long as they meet in their course with salts to dissolve, and as long as the places through which they flow are heated by the proximity of the still warm focus of the extinguished volcano, &c. &c.

Against this view of Berzelius, Von Hoff * observes, that we can by no means attribute such a small conducting power to the materials of which the interior of the earth, or earth's crust, consist, as that for thousands of years they should preserve such a temperature as that must be which can produce the phenomena we observe in such springs when they come under our observation at the surface; for, from the mean density of the

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* Geognostical Observations on Carslbad, 1825, p. 33

earth, by calculation, we may suppose its interior to consist of materials of the densest kind, which are the best conductors of heat. But were this not the case, Von Hoff continues, yet the continued exit of so considerable a quantity of heat, as that which the springs of Carlsbad discharge from the earth, must produce a considerable cooling in its interior, if the warmth was not continually generated. But since we have known these springs there has not been the smallest gradual diminution of temperature, or any of the other effects, nor, consequently, of the activity of the process; on the contrary, their force during the last century, since which their phenomena have been more accurately observed, and viewed by more experienced naturalists than formerly, has continued undiminished, and in this period several new and permanent hot springs have burst forth, without those already existing having ceased yielding water of the same quality as before.

That these objections are weighty cannot be denied; but as throughout nature, when we attempt to estimate things on the large scale, for which a sure criterion is wanting, false conclusions may easily be made; while, on the contrary, quantities found by incomplete experiments may more certainly guide us, I instituted the following experiments.

I brought basalt in a wind furnace, to the strongest white heat, till it began to melt, and then suddenly plunged it into a measured quantity of water, of a known temperature, contained in a cylindrical vessel, constructed of cast brass, on which was fitted an air-tight cover of the same metal. Immediately after the immersion of the glowing basalt in the water, the cover was applied, in order to prevent the escape of steam, and by that means of heat. On the thermometer, inserted in an opening of the cover, the bulb of which reached the water, I observed the increase of temperature as long as the hissing noise of the glowing and gradually cooling basalt was heard. The following are the results:—

1. A piece of basalt, 9 oz. weight, heated to a bright red, was plunged in 93.75 oz. of water, of 17°.7 R. The temperature of the water increased to 31°.2 R.

2. A second piece of basalt, 9 oz. weight, was heated till some melted portions dropt off, and immediately put in 112 oz. of

water, of 26°.6 R., by which the temperature was raised to 37°.5 R. When subsequently weighed it was only 7 oz.

3. A third piece of basalt, of 14.5 oz. weight, was not heated so strongly as the preceding, although it was melted in different points, and was placed in 112.5 oz. of water, at 29° R., which was raised to 48° R. The basalt afterwards weighed 13.6 oz.

4. A fourth piece, of 22 oz., was heated very strongly, but without beginning to melt. It raised the temperature of 112.5 oz. of water at 37°.5 R. to 62°.3, and then weighed 21 oz.*

In order to compare the results of these experiments with one another, we will reduce the weight of the basalt employed to 16 oz., or 1 civil pound, from which we gather, that, in the same quantity of water the elevation of temperature bore an exact relation to the mass of the glowing basalt. We will set aside the first experiment, as in it a smaller quantity of water was used. We then find 16 oz. of basalt raised the temperature of 112.6 oz. of water,—

From the second experiment,	half melted,	- -	24°.2 R.
third	a little less melted,	-	22°.31
fourth	white heat, without melting,		18°.67

These results shew a conformity which we should not have expected; for the degrees of temperature diminish just as the heat in each succeeding experiment was supposed to be less. If we admit the first experiment, which produced the greatest increase of temperature, we may assume, that 1 lb. of half-melted basalt can raise the temperature of 7 lb. of water 24° R.; consequently, 2 lb. would raise the same quantity 48° R. If we now take the mean temperature of the atmospheric water which supplies the hot springs of Carlsbad, at + 11° R., we then find that 2 lb. of half-melted basalt can raise 7 lb. of water from 11° R. to 59° R., which is the temperature of the

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* In these experiments the increase of temperature of the water must certainly be regarded as too little, from the inevitable loss of heat out of the vessel, partly by conduction, partly by radiation, and this loss must, of course, have been greater the higher the temperature of the water. This may partly have caused the less elevation of temperature in the second and third experiments, as the water was already heated by the preceding one. Any way, however, this loss of warmth was small, for I afterwards observed, that 10′ elapsed before the thermometer fell 1° R., and, in a much shorter time, the basalt had given off its heat to the water.

Sprudel Fountain at Carlsbad, as determined half a century ago by Becher, and more lately by Berzelius.

Now, the quantity of water which issues from the whole of the openings of the Sprudel is 4637$\frac{1}{8}$ eimers in an hour, which gives 469503.85 Vienna pounds *; consequently,

In 24 hours, - - - - -	$\overset{m}{11},268092.4$ lb.
365 days, - - - - -	$\overset{m}{4112},853726$
5 centuries, - - - -	$\overset{b}{2},\overset{m}{056426},863000$
7000 years, - - - -	$\overset{b}{28},\overset{m}{789976},082000$

For that is necessary,

In 24 hours, - - - - -	$\overset{m}{3},219454,9$ lb.
365 days, - - - - -	$\overset{m}{1175},101065$
5 centuries, - - - -	$\overset{m}{587550},532285$
7000 years, - - - -	$\overset{b}{8},\overset{m}{225707},452000$

of half-melted basalt to raise the water discharged by the whole Sprudel from 11° to 59° R. If we take the specific gravity of basalt at 2.9 and 1 Vienna pound $= 0.0177$ Vienna cubic feet: then would the mass of half-melted basalt required to heat that quantity of water for 7000 years, occupy a space of $\frac{8225707452.000}{2.9} \,.\, 0.0177 = 5020,517996$ Vienna cubic feet.

In order to form a rough idea of this mass, we will compare it with the cubic contents of the highest mountain in the Bohemian Mittelgeberge, the *Donnerberg*, at Milleschau. From a calculation given below, the cubic contents of this mountain, consisting entirely of clinkstone, is = 16,354,166,666 cubic feet. The above mass of basalt, which, from the hypothesis, would be necessary for the heating of the whole Sprudel Fountain at Carlsbad, since the days of Adam, according to the sacred writings, would scarcely be the third part of this mountain.

But this calculation presumes that the basaltic mass of the surrounding mountains, on the extinction of volcanic activity, was as strongly heated as the basalt itself, or that it derived no warmth from within for 7000 years, which cannot be admitted. We have also founded our calculation on the supposition, that the temperature of the Carlsbad water was formerly no higher than at present [*]. On the other hand, the atmospheric water imbibed by the earth may be heated at great depths by a high temperature existing there, so that it may reach the glowing masses much warmer than 11° R., which we have assumed. But we cannot comprehend in our estimate all these possible cases; it is sufficient that we have got an approximation. We may easily, at pleasure, increase or diminish the results, and inquire whether we are at liberty to assume the existence of such masses of basalt, or other rocks, in a half-melted state, or even at a white heat, in the interior of the earth? This much cannot be doubted, that, when we keep in view the immense masses of volcanic mountains which we find on the surface of the earth, and which we must admit have at one time been melted in its interior, from which they were projected, that even much larger masses of volcanic rocks may now exist in the interior of the Bohemian Mittelgebirge, and other volcanic ridges, in a melted, or, at least, in a glowing condition? And, if even a part of their warmth should be abstracted from such glowing masses by the surrounding mountains, nothing prevents us supposing, that, in such an event, warmth enough should still remain for the heating of the water. But this conducting power of heat can hardly be very considerable, even for a period of a thousand years; for our forges, which frequently go throughout the whole year, do not require a very thick wall of stone to confine much of the heat. And then we must look at the weak conducting power of volcanic products, which the following will prove. Monticelli and Covelli found, on the 15th January 1822, in a crater of Vesuvius, which vomited fire, a layer of snow, one foot thick, which had fallen two days before [†]. They could even touch with the hand the outside of the edge of a canal formed of congealed lava, in which the glowing rock was still flowing [‡].

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* Compare Gilbert's Annals, v. lxxiv. p. 198. I have omitted the specific gravity of the Carlsbad water, as we have only to do with approximative quantities.

Now, although, as shewn from the preceding calculations and observations, the possibility of the heat of hot springs being derived from a long extinguished volcanic point of the earth's crust, still retaining its heat in its interior, cannot be denied; yet the view of Von Hoff, of an undiminished activity of volcanic operations in the interior, under hot springs, is not thereby affected. We would, therefore, regard warm springs as standing in more intimate connexion with those processes in the interior of the earth, which produce volcanic eruptions and earthquakes, and view their high temperature and the mixture of different gases and substances, and their violent issuing forth, as the effects of this process of decomposition *. Von Hoff finds support for this view in the fact, that those points of the earth which yield a constant and considerable discharge of mineral waters, gases, vapours, &c., seem to be peculiarly exempted, if not from all internal commotions, at least from the more violent eruptions and catastrophes. Thus, it is not known that Carlsbad ever experienced a proper earthquake, for the most violent eruptions of the Sprudel cannot be considered as such. A phenomenon has lately rather tended to establish the conjecture, that Carlsbad is protected from any proper earthquake by its continual evacuations of hot gas and water. This town, and its environs, felt nothing of the pretty strong earthquake, which, in January and February 1824, extended from the base of the Saxon mountains into the circle of Elnbogen, to within two miles of Carlsbad †. Records are not wanting of an internal motion of the earth in the circle which contains the warm springs of Wiesbaden, Schlangenbad, Ems, Bertrich, and Aachen, and many accompanying cold ones; but these earthquakes were as rare, as weak, and insignificant.

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[*] Compare Von Hoff, p. in art. 35.

[†] Of Vesuvius in its activity during the years 1821, 1822, 1823, &c. from the Italian, by Nöggerath and Pauls, 1824, p. 15.

[‡] *Idem*, p. 32, and Nöggerath's Observations, p. 39.

Comparing the grounds which favour the hypothesis of warm springs having a similar origin with earthquakes and volcanic eruptions,—either that their warmth is in consequence of long extinguished volcanic activity in the place of their origin, or of a volcanic process still existing at a great depth, with the hypothesis which deduces this temperature from burning beds of

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* Von Hoff on Carlsbad, p. 56, 57. Hallasehka in Kastner's Archiv, vol. i.
turlichen Veranderungen der Erdoberfläche, 1824, part ii. p. 89.

† Von Hoff's Geschichte der durch Uberlieferung nachgewiesenen Na-
p. 323.

‡ Von Hoff's Geschichte, p. 313.

iron-pyrites and coal, the former has by far the greatest probability; and it is not to be denied, that, in a geological point of view, it is an elevating consideration, if we ascribe similar origins to volcanoes and earthquakes, and to mineral springs; and so deduce the destructive effects of the former, and the beneficial effects of the latter, from a common cause.

Keferstein, also, in his Geological Observations on the Hot and Warm Springs of Germany [*], lays down the principle, that the regular production of hot vapours and springs is connected with volcanic activity, although the volcano be at rest and shew no eruption; and that volcanic action does not consist in the combustion of beds of coal, but in terrestrial operations seated deep under the oldest formations. He observes on this, that basalt, which is connected with systems of volcanoes, is so grouped in Germany, that its localities may be viewed as a basaltic parallel, which traverses the north of Germany from west to east; and in which line also, all the hot springs of the north of Germany are situated; and that the few basalts besides this, which occur in Germany, accompany the north base of the Alps. This northern basaltic parallel, he finds, corresponds to a more southern, which traverses the south of France, the Alps, Hungary, and Transylvania. No basalt is found in the Alps themselves; but he thinks it probable that the Alps rest on a volcanic basis, that, in them, the volcanic phenomena may have been limited to some earthquakes, which may have been the more formidable, as it seems that the great mass of the mountains may have prevented the eruption of the lavas [†], instead of which, hot springs have burst a passage for themselves in many places. He shews that the greater number of them are seated in the Alps; some surround their immediate base (as also some portions of basalt); few arise in the further outskirts of the Alps. He lastly informs us, that the hot springs of Germany, and the adjoining countries, issue from the oldest formations, gneiss, granite, and clayslate; and that, where this is not the case, these older rocks are so situate in the vicinity, that we may infer them to have a connexion with the springs. That this is the case in several other parts of the world, he shews by several examples.

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[*] His work Teutchland Geognostisch-geologisch dargestelt, &c. vol. ii. pt. 1. p. 1.

[†] Compare Von Hoff's Geschichte, &c. p. 334.

If we now bring under our view what the above has taught us regarding hot springs, we come to the three following general conclusions:—1. We find hot springs and exhalations of hot gases and vapours near all active volcanoes, whence we conclude them to be intimately connected with volcanism. We also see, that permanent hot springs appear when the proper eruptions, which occur only from time to time, have ceased *. 2. We also find warm springs near extinguished volcanoes, as well as those mountains whose igneous origin is no longer disputed: But it appears that the temperature of hot springs is higher near active than extinguished volcanoes. 3. We lastly find warm springs in primitive mountain chains, which present on their surface no volcanic products; but which some geologists regard as raised by the general volcanism of the earth, at the period of its greatest activity †.

From what we have said before of hot springs, coming under heads 1. and 2., we may so lay down the principle, because hot springs, which we regard as the products of volcanic action, appear in the neighbourhood of active and extinguished volcanoes; we also infer, from what has been previously said of such springs in primitive mountains, which shew no volcanic productions, the existence of volcanic activity at a greater depth.

I have already hinted at the fact, that the temperature of the earth increases with the depth. So far we are obliged to admit volcanic action at a great depth ‡, to which the atmospheric wa-

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* Vesuvius and Etna have a number of hot springs. The now dormant volcano on Ischia has hot springs. In the volcanic district of the Lake of Agnano, the Piscarelli are 93°. Iceland is quite filled with hot springs, of which the Geyser, of 80°, is best known. The volcanic West India Islands shew the same phenomenon: likewise the volcanoes in Java, in Japan, where the springs of Ungino have a temperature of 100°; in America, &c. Keferstein, *ut antea*, p. 49. Also Von Hoff, *ut antea*, vol. ii. p. 379, 481, 485, 518, 548.

† Von Hoff, *ut antea*, p. 552.

‡ Compare Von Hoff, *ut antea*, p. 366, 367, and 549.

ter must sink to acquire its heat; yet nothing prevents its being warmed by the high temperature at that depth, independent of volcanic fires; and, in such a heated state, again appearing at the surface, if it must still rise so high; for, if the channels through which it flows become once heated, their walls would conduct little heat outwards[*]. Berzelius seems inclined to attribute this origin to the tepid, non-alkaline, but partly saline, and slightly sulphureous waters, which spring from a granitic soil, in which we find no volcanic remains[†].

I rest satisfied here with merely having pointed out this possible cause of the warmth of springs; for it would be difficult, in a field where we have merely grounds of probability, to pronounce any thing decisive.

I now resume the thread of my investigation.

Keferstein and Von Hoff have endeavoured to shew that hot springs constantly accompany volcanic ridges, but without paying any attention, in their observations, to their chemical constitution. Berzelius has, from the occurrence of mineral waters which contain soda saturated with carbonic acid, in the volcanic districts of the Bohemian Mittelgebirge, in Auvergne and the Vivarais, inferred their connexion with volcanic agency. I have also observed this connexion in the mineral waters analyzed by me, at *Geilnau*, *Fachingen*, and *Selters*; and which I will now endeavour to point out in the great basaltic or volcanic mountain chain, which begins in the Eifel, and extends to the Riesengebirge. I divide this basaltic chain into seven separate groups, and describe those springs containing carbonic acid, saturated with soda, with their relation to the geognostical character of the rocks from which they rise, or which surround them. By way of appendix, I will present, in the eighth and ninth groups, the springs belonging to this class in Auvergne, the Vivarais, and in the Pyrenees *.

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[*] A remark naturally deduced also regarding springs warmed by volcanic activity.

[†] If we look at the numerous existing observations on the temperature in the interior of the earth (see Annales de Chimie and de Physique, v. xiii. p. 183), we will observe a considerable increase of temperature at comparatively trifling depths. Thus Gensanne found in the mines of Giromagni, at Befort, in a difference of depth of 332 metres, a difference of temperature of 10°.2 C. viz. in a depth of 438 metres + 22°.7 C. In the mines of Cornwall, the temperature, at a depth of 348 metres, was + 26°; while, at the surface, it was + 15°. Von Humboldt found in a mine of New Spain, in America, at a depth of 502 metres, + 33°.8 C., while the mean annual temperature is there 16° C. We see from this, that water, which has sunk to no great depth, may be heated from 22°.7 C. to 26° or even 33°.8 C.

Examination of some Minerals. By M. Victor Hartwall †.

1. *Fergusonite.*

This mineral, named in honour of Robert Ferguson, Esq. of Raith, occurs near to Kikertaurvak, not far from Cape Farewell, in Old Greenland. On account of its near resemblance to Yttertantalite, it was referred to that species, until Haidinger, by a careful survey of its crystals, proved it to be a new species. Being analysed, it afforded to me the following constituent parts :

		Per Cent.	Oxygen.
Tantalic Acid,	0.5521	47.75	5.49
Ytter Earth,	0.4743	41.91	8.34
Oxide of Cerium,	0.0582	4.68	0.69
Zircon Earth,	0.0350	3.02	0.79
Oxide of Tin,	0.0120	1.00	
Oxide of Uranium,	0.0110	0.95	
Oxide of Iron,	0.0040	0.34	
		99.65	

The proportion of the oxygen of the bases is to that of the acids nearly as 2 : 1. This relation, although not perfectly correct, is as much so as could be expected from the analysis of so compound a mineral. Hence if we consider the combinations of Tantalic acid, and oxide of tin with zircon earth, oxide of uranium and iron, as accidental mixed parts, there results for the Fergusonite the following formula :—

$$\left.\begin{matrix}\dot{Y}^6\\ \dot{C}e^6\end{matrix}\right\}\dddot{T}a$$

The Fergusonite, therefore, differs from the yttrotantalite, in composition, the latter having its composition represented by the following formula:—

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* For the details referred to above, we must refer to Dr Bischoff's valuable work.

† From the Vetenskaps Academiens Handlingar, Jahrg, 1828.

$$\left.\begin{array}{l}\dot{Y}^3\\ \dot{C}e^3\end{array}\right\}\dddot{T}$$

2. *Manganesian Epidote or Pistacite.*

The mineral found at St Marcet in Piedmont, and known to mineralogists under the name Manganesian Epidote, was referred to the epidote genus, on account of its series of crystallizations.

This mineralogical determination it was desirous to have confirmed by chemical analysis; and, further, chemists were curious to know the particular state of oxidation of the manganese and iron which it contains. The following is the analysis of Hartwall:—

		Per Cent.	Quantity of Oxygen.
Silica, - - -	0.4425	38.47	19.35
Alumina, - - -	0.2030	17.65	8.34
Lime, - - - -	0.2490	21.65	6.08
Peroxide of Manganese,	0.1620	14.08	4.17
Peroxide of Iron, -	0.0760	6.60	2.02
Magnesia, - -	0.0210	1.82	0.70
		100.27	

I have inferred, says Hartwall, by the calculation of the result of the analysis, that the manganese and iron occur in the mineral in the state of peroxide. This is proved not only by the diminished quantity of the isomorphous alumina along with them, but also by the reddish-brown colour of the mineral. According to these data, the formula is as follows:—

$$\left.\begin{array}{l}\dot{C}a^3\\ \dot{M}g^3\end{array}\right\}\dddot{S}i+\left.\begin{array}{c}\dddot{A}l\\ 2\dddot{M}n\\ \dddot{F}e\end{array}\right\}\dddot{S}i$$

Analysis of Pyrophyllite, a New Mineral. By M. R. Hermann of Moscow.

This mineral occurs in the Uralian Mountains, and is known to mineralogists under the name Radiated Talc. But its relations before the blowpipe are different from those of indurated talc. Heated before the blowpipe, without any re-agent, it divides in a fan-shaped manner into a swollen mass, which occupies twenty times the space of the original specimen. The pounded mass is quite infusible. If heated in a glass-retort, there condenses, on the upper part of it, a water which does not attack the glass, and which, on evaporation, leaves no silica. Soda dissolves the mineral with effervescence, into a clear yellow glass. Phosphoric salt dissolves it into a colourless glass, leaving a siliceous skeleton. It acquires a blue colour with solution of cobalt. By these characters the mineral is well marked, and is distinguished from talc, particularly by its relations with solution of cobalt, its aqueous contents, and its fan-shaped splitting by heating. But in order to obtain a more distinct conception of this mineral, I subjected it to analysis. According to this, it contains in the 100 parts

5.62	Water, - - -	5.00 Oxygen.
59.79	Silica, - - -	30.07
29.46	Alumina, - - -	13.75
4.00	Magnesia, - - -	1.55
1.80	Oxide of Iron.	
	Trace of Oxide of Silver.	

We see from this analysis, that the oxygen of the water amounts to a third, and the oxygen of the silica the double of the oxygen of the bases. The mineral thus analysed, therefore, corresponds to the following formula:—

$$\dot{M}^3\,\dddot{S}i^2 + 3\,\dddot{A}I^3 + IO\dot{H}.$$

The name Pyrophyllite is given to it on account of its exfoliation on exposure to heat.

Additional Remarks on Active Molecules. By Robert Brown, F. R. S. &c.

About twelve months ago I printed an account of Microscopical Observations made in the summer of 1827, on the Particles contained in the Pollen of Plants; and on the general Existence of active Molecules in Organic and Inorganic Bodies.

In the present supplement to that account, my objects are, to explain and modify a few of its statements, to advert to some of the remarks that have been made, either on the correctness or originality of the observations, and to the causes that have been considered sufficient for the explanation of the phenomena.

In the first place, I have to notice an erroneous assertion of more than one writer, namely, that I have stated the active molecules to be animated. This mistake has probably arisen from my having communicated the facts in the same order in which they occurred, accompanied by the views which presented themselves in the different stages of the investigation; and in one case, from my having adopted the language, in referring to the opinion of another inquirer into the first branch of the subject.

Although I endeavoured strictly to confine myself to the statement of facts observed, yet in speaking of the active molecules I have not been able, in all cases, to avoid the introduction of hypothesis; for such is the supposition, that the equally active particles of greater size, and frequently of very different form, are primary compounds of these molecules,—a supposition which, though professedly conjectural, I regret having so much insisted on, especially as it may seem connected with the opinion of the absolute identity of the molecules, from whatever source derived.

On this latter subject, the only two points that I endeavoured to ascertain, were their size and figure: and although I was, upon the whole, inclined to think that in these respects the molecules were similar from whatever substances obtained, yet the evidence then adduced in support of the supposition was far from satisfactory; and I may add, that I am still less satisfied now that such is the fact. But even had the uniformity of the molecules in those two points been absolutely established, it did not necessarily follow, nor have I any where stated, as has been imputed to me, that they also agree in all their other properties and functions.

I have remarked, that certain substances, namely, sulphur, resin, and wax, did not yield active particles, which, however, proceeded merely from defective manipulation; for I have since readily obtained them from all these bodies: at the same time I ought to notice that their existence in sulphur was previously mentioned to me by my friend Mr Lister.

In prosecuting the inquiry subsequent to the publication of my observations, I have chiefly employed the simple microscope mentioned in the pamphlet, as having been made for me by Mr Dollond, and of which the three lenses that I have generally used, are of a 40th, 60th, and 70th of an inch focus.

Many of the observations have been repeated and confirmed with other simple microscopes having lenses of similar powers, and also with the best achromatic compound microscopes, either in my own possession, or belonging to my friends.

The result of the inquiry at present essentially agrees with that which may be collected from my printed account, and may be here briefly stated in the following terms: namely,

That extremely minute particles of solid matter, whether obtained from organic or inorganic substances, when suspended in pure water, or in some other aqueous fluids, exhibit motions for which I am unable to account, and which, from their irregularity and seeming independence, resemble in a remarkable degree the less rapid motions of some of the simplest animalcules of infusions; that the smallest moving particles observed, and which I have termed Active Molecules, appear to be spherical or nearly so, and to be between 1-20,000dth and 1-30,000dth of an inch in diameter; and that other particles of considerably greater and various size, and either of similar or of very different figure, also present analogous motions in like circumstances.

I have formerly stated my belief that these motions of the particles neither arose from currents in the fluid containing them, nor depended on that intestine motion which may be supposed to accompany its evaporation.

These causes of motion, however, either singly or combined with others,—as, the attractions and repulsions among the particles themselves, their unstable equilibrium in the fluid in which they are suspended, their hygrometrical or capillary action, and in some cases the disengagement of volatile matter, or of minute air-bubbles,—have been considered by several writers as sufficiently accounting for the appearances. Some of the alleged causes here stated, with others which I have considered it unnecessary to mention, are not likely to be overlooked or to deceive observers of any experience in microscopical researches; and the insufficiency of the most important of those enumerated, may, I think, be satisfactorily shown by means of a very simple experiment.

This experiment consists in reducing the drop of water containing the particles to microscopic minuteness, and prolonging its existence by immersing it in a transparent fluid of inferior specific gravity, with which it is not miscible, and in which evaporation is extremely slow. If to almond-oil, which is a fluid having these properties, a considerably smaller proportion of water, duly impregnated with particles, be added, and the two fluids shaken or triturated together, drops of water of various sizes, from 1-50th to 1-2000dth of an inch in diameter, will be immediately produced. Of these, the most minute necessarily contain but few particles, and some may be occasionally observed with one particle only. In this manner minute drops, which if exposed to the air would be dissipated in less than a minute, may be retained for more than an hour. But in all the drops thus formed and protected, the motion of the particles takes place with undiminished activity, while the principal causes assigned for that motion, namely, evaporation, and their mutual attraction and repulsion, are either materially reduced or absolutely null.

It may here be remarked, that those currents from centre to circumference, at first hardly perceptible, then more obvious, and at last very rapid, which constantly exist in drops exposed to the air, and disturb or entirely evercome the proper motion of the particles, are wholly prevented in drops of small size immersed in oil,—a fact which, however, is only apparent in those drops that are flattened, in consequence of being nearly or absolutely in contact with the stage of the microscope.

That the motion of the particles is not produced by any cause acting on the surface of the drop, may be proved by an inversion of the experiment; for by mixing a very small proportion of oil with the water containing the particles, microscopic drops of oil of extreme minuteness, some of them not exceeding in size the particles themselves, will be found on the surface of the drop of water, and nearly or altogether at rest; while the particles in the centre or towards the bottom of the drop continue to move with their usual degree of activity.

By means of the contrivance now described for reducing the size and prolonging the existence of the drops containing the particles, which, simple as it is, did not till very lately occur to me, a greater command of the subject is obtained, sufficient perhaps to enable us to ascertain the real cause of the motions in question.

Of the few experiments which I have made since this manner of observing was adopted, some appear to me so curious, that I do not venture to state them until they are verified by frequent and careful repetition.

I shall conclude these supplementary remarks to my former observations, by noticing the degree in which I consider those observations to have been anticipated.

That molecular was sometimes confounded with animalcular motion by several of the earlier microscopical observers, appears extremely probable from various passages in the writings of Leeuwenhoek, as well as from a remarkable paper by Stephen Gray, published in the 19th volume of the Philosophical Transactions.

Needham also, and Buffon, with whom the hypothesis of organic particles originated, seem to have not unfrequently fallen into the same mistake. And I am inclined to believe that Spallanzani, notwithstanding one of his statements respecting them, has, under the head of *Animaletti d'ultimo ordine*, included the active molecules as well as true animalcules.

I may next mention that Gleichen, the discoverer of the motions of the particles of the pollen, also observed similar motions in the particles of the ovulum of zea mays.

Wrisberg and Muller, who adopted in part Buffon's hypothesis, state the globules, of which they suppose all organic bodies formed, to be capable of motion; and Muller distinguishes these moving organic globules from real animalcules, with which he adds, they have been confounded by some very respectable observers.

In 1814, Dr James Drummond of Belfast, published, in the 7th volume of the Transactions of the Royal Society of Edinburgh, a valuable paper, entitled "On certain appearances observed in the Dissection of the Eyes of Fishes."

In this Essay, which I regret I was entirely unacquainted with when I printed the account of my observations, the author gives an account of the very remarkable motions of the spicula which form the silvery part of the choroid coat of the eyes of fishes.

These spicula were examined with a simple microscope, and as opake objects, a strong light being thrown upon the drop of water in which they were suspended. The appearances are minutely described, and very ingenious reasoning employed, to show that, to account for the motions, the least improbable conjecture is to suppose the spicula animated.

As these bodies were seen by reflected and not by transmitted light, a very correct idea of their actual motions could hardly be obtained; and with the low magnifying powers necessarily employed with the instrument and in the manner described, the more minute nearly spherical particles or active molecules which, when higher powers were used, I have always found in abundance along with the spicula, entirely escaped observation.

Dr Drummond's researches were strictly limited to the spicula of the eyes and scales of fishes; and as he does not appear to have suspected that particles having analogous motions might exist in other organized bodies, and far less in inorganic matter, I consider myself anticipated by this acute observer only to the same extent as by Gleichen, and in a much less degree than by Muller, whose statements have been already alluded to.

All the observers now mentioned have confined themselves to the examination of the particles of organic bodies. In 1819, however, Mr Bywater, of Liverpool, published an account of Microscopical Observations, in which it is stated that not only organic tissues, but also inorganic substances, consist of what he terms animated or irritable particles.

A second edition of this essay appeared in 1828, probably altered in some points, but it may be supposed agreeing essentially in its statements with the edition of 1819, and which I have never seen, and of the existence of which I was ignorant when I published my pamphlet.

From the edition of 1828, which I have but lately met with, it appears that Mr Bywater employed a compound microscope of the construction called Culpepper's, that the object was examined in a bright sunshine, and the light from the mirror thrown so obliquely on the stage as to give a blue colour to the infusion.

The first experiment I here subjoin in his own words:—

"A small portion of flour must be placed on a slip of glass, and mixed with a drop of water, then instantly applied to the microscope; and if stirred and viewed by a bright sun, as already described, it will appear evidently filled with innumerable small linear bodies, writhing and twisting about with extreme activity."

Similar bodies, and equally in motion, were obtained from animal and vegetable tissues, from vegetable mould, from sandstone, after being made red hot, from coal, ashes, and other inorganic bodies.

I believe that in thus stating the manner in which Mr Bywater's experiments were conducted, I have enabled microscopical observers to judge of the extent and kind of optical illusion to which he was liable, and of which he does not seem to have been aware. I have only to add, that it is not here a question of priority; for if his observations are to be depended on, mine must be entirely set aside.

On the Tripang, or Bicho de Mar, or Sea-Slug of India—the Holothuria tubulosa of Naturalists. By CHARLES COLLIER, formerly Staff-Surgeon in Ceylon, now Inspector of Hospitals in the Mauritius. Communicated by Sir JAMES MACGRIGOR. With a Plate.

HAVING had many opportunities of observing this species, and thinking that, although its organisation is already known in a general sense, a complete account of it may be interesting to naturalists, I submit the following memoir on the subject*,

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* A beautiful memoir on the structure of the Holothuria tubulosa by Tiedemann was published in 1816. EDIT.

Some advantage is derived from it, as an article of commerce, in Ceylon; for, after being dried, it is exported in large quantities to China [*]. The animal is found throughout the year on this coast, attached to rock, or lying on the sand, surrounded by species of Haliotis, Patella and Lepas, in shallows close to the shore. Its surface is of a deep black colour, soft and gelatinous to the feel, and studded over with papillary bodies [†], by means of which, it attaches itself to objects, and probably absorbs the water, with which its cavity is always more or less distended. Its length and circumference vary exceedingly [‡], both from age and rapid but partial contraction. The extremity where the mouth is situated is flat, compared with the opposite end, where the anus is, and which is tapering. Through this latter aperture, the water contained within the sac is thrown with considerable force. It can withdraw, as M. Lamarck has observed, all its external organs [§]; and it can, besides, expel through the posterior opening, or by rupture, through the outer covering, all its internal organs, leaving the empty sac (as it may be termed) to part, after a few hours, with the signs of vitality [‖].

The mouth [¶] is strengthened with a calcareous or cartilaginous serrated ring[*], and surrounded by twenty pinnated tentacula (tentaculis racemosis, Linn). Connected with and opening into it are many small, transparent, oblong bodies, (one of which, always distended with fluid, is larger than the others) which, in the opinion of M. Cuvier [†], are secretory organs. The alimentary canal [‡], and its retaining membrane (mesentere membraneux, Cuv.), have been already described in the *Leçons d'Anatomie Comparée*; but the term *Cloaca* [§], which has been employed, is applicable, not to the termination of the intestine, which is smaller than the rest of the canal, but to the kind of sac, formed by the transverse membrane, into which the bowel opens.

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[*] This employment of it has been alluded to by Linnæus, for he inquires: An hæc quæ, teste Ill. Pallas, siccata, Sinensibus in cibum cedit? Syst. Nat. part vi. p. 3139.

[†] The apices of these papillary bodies are white, and flattened, or rather concave and perforated. They resemble, excepting in size, those which are extended along the branches of the asterias, and described minutely by M. Cuvier, in his Leçons d'Anatomie Comparée, vol. i. p. 407.

[‡] An individual is sometimes found eighteen inches long. Crawford says, some of the Tripang or Holothuriæ are as much as two feet in length, and from seven to eight inches in circumference. The length of a span, and the girth of from two to three inches, however, is the ordinary size. Edit.

[§] Les Holothuries sont tres contractiles, elles font rentrer, facilement et completement, tous leurs organes exterieurs, tels que leurs tentacules, leur bouche meme, leurs papilles, et leurs tubes aspiratoires. Hist. Nat. des Anim. sans Vert., vol. iii. p. 73.

[‖] This expulsion has not, so far as I know, been noticed by authors, but it follows so uniformly the least violence, or removal for a short period from the habitat, that a view of the parts *in situ* can very rarely be obtained. It is noted by Tiedemann.—Edit.

[¶] Linnæus supposed that, as in the asterias, there was but one opening for the alimentary canal:—"Holothuriæ omnes, maris incolæ, per aperturam anteriorem nutrimentum hauriunt et fæces expellunt; per posteriorem aquam ingressam ejiciunt." Syst. Nat. part vi. p. 3140.

The vascular system [||] is so intricate and peculiar, that it is indeed difficult, even after patient labour, to form a clear and connected view of its constitution. The following is the result of my investigations. A large vessel can be traced from the summit of the membranous expansion, close to the entry and termination of the intestine, to the lung[*], and is there seen to ramify; and from the lung arise distinct groups of vessels, which unite into one, and this again immediately divides into many short branches, like *vasa brevia*, which pass directly to and encircle the contiguous intestine; and it sends one branch upwards, which may be followed to the mouth, and another downwards, which is lost on the second line of the intestine. A branch, too, is sent to the organs, which are, as is supposed, for reproduction. This would appear to be the distribution from the lung. Now, the pulmonary vessel is joined, at its origin, by another, which descends, gradually enlarging, along the floor of the covering, and by a vessel besides[†] of extreme tenuity, from off the intestine at the anus, which may be traced enlarging as it recedes from this point, along the whole course of the canal. This junction of the three vessels forms a sac between the lamina of the membranous expansion, and into this sac, if I may trust my dissection, the vessels open; but as no impelling power can be detected, the further transmission of the fluid is not apparent.

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[*] M. Cuvier decides, but hastily I think, that this apparatus serves only as a point of attachment for the longitudinal muscles:—"Les Holothuries ont bien l'ouverture de la bouche entourée d'un anneau, formé de dix pieces demi-osseuses, mais elles servent seulement de point d'apui aux muscles longitudinaux du corps, et aux tentacules recouvertes par la peau interieure de la bouche, et ne contenant aucune dent, elles ne servent point à la mastication. Vol. iii. p. 336.

[†] Les Holothuries ont tout autour de leur bouche des sacs oblongs et aveugles, qui débouchent dans cette cavité, et qui ne peuvent manquer d'y verser quelque liqueur analogue à la salive. Vol. iii. p. 340.

[‡] The alimentary canal is of the same caliber, exceedingly delicate in its texture, about four times the length of the animal, and disposed in three lines of unequal length; that is, it descends, returns to the right, crosses, and again descends to the anus. The tenuity (and consequently apparent unfitness for their office) of the tunics of the intestine, is found in some testaceous mollusca also, and in those more particularly (as *Murex tulipa* and *saxatilis*, and *Trochus niloticus*) which inhabit coarse shells. In the last mentioned species the parts can seldom, with all care, be displayed without injury, and yet very rough matter (as coral, and shells comminuted and entire) has to pass along them. Fluid is found within the intestine, between portions filled with solid matter; and this fluid, like that within the cysts, which are appended to the mouth, appears to be, from taste and appearance, sea-water.

[§] L'anus s'ouvre dans le grand cloaque situé à l'arrière du corps, et qui n'est separé de la cavité de l'abdomen, que par une valvule. Vol. iv. p. 143.

[||] M. Cuvier bears testimony to the difficulty of this branch of the subject:—"Je suis contraint d'avouer que, malgré tous mes efforts, je n'ai pu encore parvenir à me faire des ideés certaines, sur l'organization des Echinodermes, à l'egard du systeme vasculaire." Vol. iv. p. 414. I have not been able, I confess, even with the subject before me, to follow this able anatomist's demonstration.

The nervous system is so obscure, that I confess I know nothing about it.

Connected by a vessel with the lung and the intestine, is a large mass[‡], constituted by a congeries of long circular worm-like bodies, which, in some individuals, are red, and in others greyish white. And attached to this mass by cohesion, is a loose congeries of white, narrow, delicately serrated, filamentous particles, which are so glutinous as to adhere to objects, and are highly elastic. Some of these filaments are often seen issuing, as it were, from the posterior opening; and they are always first protruded. In small and apparently young individuals, these parts are scarcely to be discerned. If these be the sexual organs, the mode of reproduction and the kind of influence which may be mutually exercised, seem to be beyond the reach of observation, and to admit, therefore, of no elucidation.

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[*] The lung is of a reddish-brown hue, and appears like ramifications of vessels, among very loose cellular fibre, charged with fluid.

[†] The course of this vessel may be worth notice. It passes from the mouth, enlarging to about the centre of the œsophageal or first line of the canal, and then bifurcates, sending one branch under the lung to the opposite line of the intestine, which again bifurcates, and then completes the whole course of the canal; it empties itself, being, as was observed, of extreme tenuity, at the anus, into the pulmonary vessel. If it be a returning vein, it is singular that it should be smallest where it joins the apparent origin of the circulation.

[‡] The quantity and the form are alike in two individuals found together, while the colour thus differs. Does this variation depend upon any period of particular activity of the organ? M. Cuvier considers that as an *ovary*, and conjectures that the white filamentous bands have some relation with male organs:—"Je crois que ces sont les ovaries de ces animaux: mais on observe aussi, vers leur anus, des filamens blanchatres, nombreux, semblable

The covering without is, as has been observed, black, beset with papillæ, and it gives off a slight purple tint, such as that of *Murex Tulipa*; within, it is furnished with delicate transverse fibres, and broad muscular bands, which are extended from the posterior extremity, and attached to the gristly circle of the mouth, or to the summit behind the mouth. A membrane is extended across the posterior extremity, and beneath it lies the contracted termination of the intestine; and within its laminæ commences apparently the system of the circulation.

The Tripang, Sea-Slug, or Holothuria Trade in India. By the EDITOR.

This animal is used very extensively by the Chinese for culinary purposes. They make of it a very rich and palatable soup, and dress it in different kinds of stews. There are various modes of curing it. It is first gutted, and the water pressed out of it, and then laid in dry lime, called by the natives *chunam*; afterwards, according to the circumstances of the fishing station, dried in the sun, or on stages, by means of fires of wood under them. It is a most important article of commerce, and is the most considerable article of the exports of the Indian islands to China, unless, perhaps, pepper. There are fisheries, as they are called, of Tripang, in every country of the Indian Archipelago, from Sumatra to New Guinea. It

à des vers, et formés chacun d'un fil mince, assez elastique, contourné en spirale, et se laissant dé'rouler. Ces organes auroient ils quelque rapport avec le sex male?" Vol. v. p. 200. The ovary-like mass weighs, in some individuals, nearly two ounces.

has also, within these last few years, been discovered abundantly on the coasts of Ceylon and the Isle of France, and is no doubt general throughout those seas. It has, as we are informed, already been sent from thence to China, where it finds a ready market; although, from its being unskilfully prepared, it is classed with the lowest qualities of the Archipelago. When the Chinese can be employed in fishing and preparing it, there is little doubt that it will form an important article in the commerce of those countries with China, as it can be got in any quantities. Judging from the extent and population of China, and their taste for such articles, where, along with the birds' nests (a peculiar product of the Archipelago), it forms as indispensable an article of luxury as the tea of China does to this country, especially among the higher orders, it will not be an easy matter to glut the market with it.

Being found principally on coral reefs, and never on flat muddy shores, the most considerable fisheries are consequently to the eastward from Celebes to New Guinea and Australasia, where the form of the land is the most favourable. The animal is caught on ledges of coral rock, usually at the depth of from three to five fathoms. The larger kinds, when in shallow water, are occasionally speared, but the most common mode of taking them is by diving for them in the manner practised for pearl oysters, and taking them up with the hands. The most productive are the fisheries among the Aroe Islands, and those in the Gulf of Carpentaria, and generally on all the north-west coast of New Holland. Upwards of forty vessels, of from twenty to fifty tons, leave Macassar annually for the coast of New Holland, besides others that go elsewhere in the same trade. A vessel of twenty tons, manned by twenty-five hands, is considered to be successful, if she have obtained seven thousand pounds weight of Tripang. It is, says Crawford, the capital of the Chinese resident merchants which sets these adventures on foot, as they advance to the undertakers from two to four hundred Spanish dollars, according to the extent of their equipment, securing to themselves the refusal of the cargo.

The holothuriæ, as already mentioned, vary in size, but their quality or value in the market does not depend on size, but upon properties which are understood only by those who have had a long experience of the trade. The Chinese merchants are almost the only persons who possess this skill; even the native fishers themselves, as Crawford remarks, being often ignorant on the subject, and always leaving the cargo to be assorted by the Chinese on their return to port. The commercial classification made by the Chinese, is curious and particular. In the market of Macassar, the greatest staple of this fishery, not less than thirty varieties, are distinguished, varying in price from five Spanish dollars per *picul* (picul is 133⅓ lbs.) to fourteen times that price, each being particularized by well-known names. It is evident from this account, says Crawford, that the Tripang trade is one in which no stranger can safely embark, and it is consequently almost entirely in the hands of the Chinese. The quantity of Tripang sent annually to China from Macassar is about 7000 piculs, or 8333 cwt. The price in the market of China varies from eight Spanish dollars per picul, to 20, to 50, to 75, to 110, and to as high as 115, according to quality.

The whole quantity sent to China from Macassar, and other parts of India, may be estimated at 14,000 piculs. Taking this quantity at the low average of 40 dollars a picul, and valuing the dollar at 4s. 3d., its entire value, in a commercial view, is L.119,000. Notwithstanding this enormous export to China, we do not understand that its value in the market has ever been materially affected by the quantity imported, an evident proof that the demand of the market still exceeds the supply. When we reflect that the opium, pepper, birds' nests, sharks' fins, tripang, and various other articles, the products of the countries under our controul, which are fully as indispensable to the Chinese as the teas of China are to Europe, the fear so much entertained of the Chinese interdicting our trade with that empire is quite preposterous. In short, these few articles of luxury give us the command of the Chinese tea market. The celestial empire cannot exist without its tripang and birds' nests.

Observations on the Ancient Roads of the Peruvians. By JOHN GILLIES, M. D. M. W. S., &c. Communicated by the Author *.

MY attention was first directed to these roads in January 1825, when, with the view of examining the celebrated silver mines of Uspallata, I was induced to pay a visit to the owner of one of these who was likewise the proprietor of the neighbouring Valley of Uspallata. It being then the hottest season of the year at Mendoza, his family had removed with him to his residence in the valley, to enjoy the cool air of the mountains. Attached to the house were to be seen all the machinery and other requisites for grinding and amalgamating the silver-ores; some people were then employed in reducing the ores which had been previously collected, the whole being under the superintendance of Don Jose Arroyo, a native of Peru, somewhat advanced in life, and whom I found intimately acquainted with the topography of his own country, and the customs most prevalent among them. He had taken an active part in the revolutionary proceedings in Peru against the dominion of Spain, and as Peru was still in the hands of the Spaniards, he had then, like many others of his countrymen, taken refuge in one of the neighbouring provinces, which had been more fortunate in their endeavours against the mother country.

While enjoying the hospitality of my friends, I took advantage of the occasion to visit all the most interesting objects which presented themselves in the neighbouring mountains and valley, and, among others, at the recommendation of the Peruvian already mentioned, was induced to visit the western side of the valley, at which place there existed, as he had been some time previously informed, very distinct traces of these ancient roads, usually known by the name of Camino del Inga, or road of the Incas, some instances of which he had previously witnessed in Peru; and the result of my visit was such as gratified me far beyond my expectations.

On first seeing these roads, I was much surprised at finding them in such high preservation, that their extent and dimensions could be distinctly traced to a great extent, although there is every reason to conclude that they have been rarely trodden on by the foot of the traveller, since the discovery and conquest of these countries by the Spaniards, now more than 300 years ago. I examined the road in several places, at some distance from each other, and found it to measure fifteen feet in breadth. The principal preparation which it seemed to have undergone was that of levelling, and the removal of all impediments, such as shrubs, large stones, &c.; its surface consisted principally of the soil, gravel, and small stones, which characterized the surrounding district, and seemed altogether to constitute a road sufficient for all the purposes of communication, in a country where it is so little liable to injury from the elements, and to a people who made all their journeys on foot, and possessed no other beasts of burden except the llamas and alpacas, none of which, it is probable, ever accompanied them to such a distance from their native country. The circumstance which appeared the most remarkable, was the total absence of every kind of shrubs from the line of road, unless where it had been crossed by some occasional mountain torrent, or more permanent water-course, which, carrying down with it some of the neighbouring shrubs, had left them there to take root: with this exception, its surface exhibited no other vegetation, except occasional tufts of grass, or of some herbaceous plants. Such inconsiderable encroachments of vegetation, during so long a period of time, may at first sight appear somewhat extraordinary, yet is easily accounted for in a climate such as that which characterizes the Valley of Uspallata, where it seldom rains, and where scarcely any dew falls; so that there generally does not exist sufficient moisture to nourish any other than a scanty vegetation, consisting of some thorny and resinous shrubs, with a few patches of grass, and other less conspicuous plants. This remarkable difference in the vegetation of the line of road, and the surrounding country, renders the former particularly evident, more especially when viewed from the elevated part of it, which approaches the base of the mountains, where it is called La Punta del Cerro Negro. From this situation it may be traced, as far as the eye can reach, in one continued line, proceeding in the direction, by compass, of north by west. Unless where nature has presented almost unsurmountable obstacles to their doing so, they seem, in forming these roads, to have invariably followed the most direct course, disregarding ordinary inequalities in the surface, which might have been avoided by an inconsiderable detour.

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* Read before the Wernerian Natural History Society, December 5. 1829.

In the subsequent conversations which I had with the Peruvian and other travellers on this subject, I ascertained that very distinct traces of these ancient roads are not only to be seen in many parts of Peru, but are frequently met with along the line of the Cordillera, which proceeds from Uspallata to Potosi in Peru, but only in such places where they have not been effaced by coming in contact with more modern roads. It may be distinctly traced from the place where I first examined it, along the whole extent of the Valley of Uspallata, which is said to terminate at the river of St John's (Rio de San Juan), upwards of 100 miles to the northward. It has also been traced as far to the southward as the Valley of the Tenuyan, about 34 degrees of south latitude, where, on the following year, when passing the Cordillera, by the pass of the Planchon, I made a fruitless attempt to discover it, none of my guides being sufficiently acquainted with the localities of the valley, to be able to point it out to me. From this valley, I have not yet been able to trace its course further south, either personally or by the testimony of others; yet I have little doubt, that, by a careful investigation, it might be ascertained to continue much farther to the south. From the Valley of Uspallata it takes rather a circuitous course to reach the Valley of the Tenuyan: on leaving La Punta del Cerro Negro, it runs southward, and soon inclines more to the westward, until, at Los Ranchillos, it leaves the Valley of Uspallata, and joins with the high road to Chile, which skirts the northern side of the Rio de Mendoza, as far as La Punta de las Vacas, passing in this route by Picheuta and Tambillos, places whose names are of Indian origin. At the latter place are still to be seen the ruins of some habitations, supposed by many to have been used by the Peruvians during their journeys; but, by others, and perhaps with more probability, as having been erected to give temporary shelter to the negro slaves, who were formerly carried from Buenos Ayres across the mountains, by this road, for the supply of Chile and Peru. At La Punta de las Vacas, the Incas road again leaves the high road, and may be traced across the river of Mendoza, and along the Valley of Topongato, to the foot of the lofty mountain of that name, by which, it passes into the Valley of the Tenuyan.

The early Spanish writers on these countries give details respecting these royal roads of the Incas; and, among other things, state, that from Cusco there existed a double line of these roads, over an extent of about 500 leagues, towards Quito, the one being made along the plains, at great trouble and expence, to obviate the difficulties presented by a sandy and loose soil, and the other along the mountains, in which cases ridges were levelled and valleys filled up, the latter being preferred in summer. These roads were twenty-five feet wide, and, at regular distances, had palaces, store-houses, and other habitations, for the use of the officers of the royal house and of the revenue. From Cusco these roads also proceeded in a southerly direction, dividing into several branches, one of which passing through Potosi, was continued by the route now called Camino del Despoblado, along the Cordillera of the Andes, belonging to Salta, La Rioja, San Juan, and Mendoza, the continuation of which is seen at Uspallata. This branch must have been originally formed for the purpose of communicating with the Araucanian Indians, and the other nations inhabiting Chile, and those tribes which inhabit the country along the eastern side of the Southern Cordillera of the Andes, and from thence to the Southern Atlantic Ocean and Cape Horn, all of whom are of quite a different race, and speak a language very different from the Quichua, or language of the Peruvian Indians. The cause why they seem to have preferred this route to any other, may be supposed to have been the greater abundance of water and other conveniences for travellers, than along either side of the mountains; these, in many places, being very scarce on the eastern side, and are altogether awanting on the western, where the desert of Atacama, bounded on the one side by the Pacific Ocean, and on the other by the Andes, is quite impassable. Besides, the mountain route may be presumed to have been safer, more free from interruption, and more centrical for the purpose of communication with the various nations inhabiting both sides of the Andes. It is evident, from the size of these roads, and the precision and care with which they have been formed, that their intercourse with these nations must have been considerable; and they are calculated to convey to us high ideas of the energy and civilization of the Indians of Peru, before they had any knowledge of European costoms. At the present day, the Peruvian Indians are so tenacious of the customs and habits of their ancestors, that they generally prefer travelling on foot to every other mode, and thus, from constant habit, are capable of performing on foot very long journeys in a short space of time, without exhaustion, and with very little nourishment. To this cause may with justice be ascribed the circumstance of the Spanish officers, during the late war of independence, having so effectually retained this part of the new world under the dominion of the mother country; almost the whole of their infantry was composed of these Indians, with whom they were able to make such long and rapid marches, as rendered them, in a mountainous country, superior in point of mobility to any other force which could be brought against them. Some of these Indians, who are called Cholos by the people to the south, even now occasionally travel on foot from Peru, along these mountain routes, to visit Chile, Mendoza, and other places, where they carry on a petty traffic with gums, and various vegetable products of their own country, and a few articles of their own manufacture. This mountain route, in a considerable part of its extent, is also at the present day frequented by such of the inhabitants of Mendoza and San Juan as convey troops of mules for sale, and carry brandies and other articles of produce to Upper Peru, or Bolivia, as it is now called. This road is considered by them to be the most direct, and preferable to any other, on account of the plentiful supply of water, fire-wood, and pasture for their mules; and it is probable that, in time coming, it will be much frequented for similar purposes. This route is traversed in various parts of its extent, by a number of passes across the Cordillera of the Andes, among which, north of that of Uspallata, may be mentioned, the Pass of Los Patos, celebrated as the road by which General San Martin crossed with his army from Mendoza to Chile before the battle of Chacabuco. Further to the north are situated the respective passes which communicate between San Juan and Coquimbo, and between La Rioja and Copiapo, which latter place is situated on the southern boundary of the desert of Atacama; and in that part which is denominated El Despoblado, it is crossed by the road which communicates from Salta to the port of Cobija, at the northern extremity of the Atacama desert. This latter place has of late risen to some importance, having, under the name of El Puerto Lamar, been erected into a free port by the government of Bolivia, for the introduction of goods into that country, so as to avoid the heavy transit duties and other charges to which they are subjected, on passing through the port of Arica and other parts of the Puertos Intermedios, which belong to the Peruvian Republic, or the government of Lower Peru. This spot, which is the only place where the Republic of Bolivia communicates with the Pacific Ocean, notwithstanding all the encouragement given to it by an almost entire exemption from duties, is yet so scantily supplied with water for the use of man and beast, that it can never become a place of extensive population.

On the Stomach of the Manis pentadactyla of Ceylon. By C. T. Whitefield, Esq., Assistant-Surgeon, Royal Artillery. Communicated by Sir James Macgrigor, Director-General of the Army Medical Department, &c. &c. With a Plate.

A few weeks ago, while engaged in the dissection of an individual of the Edentated family, Pangolin, "Manis pentadactyla" (or trivially, Scaly Lizard), I observed, within its stomach, a cyst, which, as it was filled with a vast number of worms of the Ascaris genus, I was led to consider as a deviation from the natural structure of the organ. But having since examined the stomach of two other individuals, in which the same features were found, that conclusion has been necessarily abandoned. This structure appears to me, from its peculiarities, to deserve the notice of those engaged in the pursuit of comparative anatomy; and Baron Cuvier having described distinctly, in his Anatomie Comparée (vol. iii. p. 387.), the form, division, and pyloric granular structure of this stomach, and yet left unnoticed the part here more particularly alluded to, I am induced to offer the following observations on the subject:—

The stomach of the pangolin *in situ*, differs but little in outward appearance from the stomach of many of the mammalia, its division into two cavities being scarcely perceptible; but its muscular fibres are stronger and more apparent, particularly in the cardiac portion, and some may be traced readily to the pylorus. When laid open, however, the two cavities are very evident, and are distinguished, not only by the thickness and strength of their parietes, but also by their lining membrane. The membrane of the cardiac portion is rugous, or puckered into numerous irregular folds; and the membrane of the pyloric portion resembles the thick coriaceous lining of the gizzard of the gallinacea. In this part may be observed numerous openings, the excretory ducts of a large granular structure which is there situated. Between these two portions of the viscus is situated the peculiar cyst-like structure, the form, exact position, and aperture of which may be better understood by a reference to the accompanying Plate I., than by any verbal description. It is lobulated, and resembles the convolutions of the cerebrum, covered with the pia mater. It occupies nearly the centre of the large curvature of the stomach, and projects into its cavity; is of an elliptic form, with its long diameter placed transversely, and is covered by the inner membrane of the stomach, which is here smooth. In the centre of the side towards the pylorus, is a large opening, leading into a cavity, and thence into several chambers, which are constituted by the lobe-like structure I have described. The margin of this opening is studded with follicular glands, which are continued in a chain towards the pylorus; and the inner surface is highly vascular, and secretes a ropy mucous fluid.

Insects, particularly ants, form the principal food of the pangolin, and of many others of the edentated family, and for obtaining these, its long and delicate tongue, for penetrating into small cavities, seems to be well adapted. But it may be assumed, that insects are not its only food, and that there is strength and provision as great as with the gallinacea, for triturating and digesting grain or roots, and the very strong and talon-like nails (well adapted for turning up the earth), with which the fore-feet are furnished, would seem to favour the conclusion.

Within the stomach there was a quantity of sand, gravel, and small pebbles, but there were no traces of food. In one instance, within the lobulated body, there was, as I have already noticed, a vast number of living ascarides; but, in a second instance, a few only were found, and in a third there were many. Are these worms taken in from without, or are they generated within the viscus? If generated there, do they find a retreat within the chambers of the central cavity, during the early and triturating process of digestion?

Repetition of M. Dutrochet's Experiments on the Mimosa pudica. By ROBERT SPITTAL, Esq. one of the Presidents of the Plinian Natural History Society.

As I have not observed any notice of M. Dutrochet's experiments on the Mimosa pudica having been repeated in this country, perhaps the following communication, containing an account of some of these which I performed during the summer of 1828, and again during the summer of 1829, may not be altogether uninteresting.

To give an idea of the opinion of this philosopher on the structure and functions of the sensitive plant, I shall, before describing the corroborative experiments, present, in a few words, a general view of those points which most concern the present topic, that what follows may be the better understood.

After much research, M. Dutrochet concludes that the Mimosa pudica possesses the elements of a diffused nervous system, more especially developed in the leaves and bourrelets situated at the base of the petioles. This nervous apparatus, he observes, is seen on the walls of the cells and tubes of the plant, in the form of small semitransparent globular and linear bodies, which become opaque from the action of acids, and transparent from that of alkalies. He believes that all the motions of the sensitive plant are spontaneous, or depend on an internal principle, which receives the impressions of external agents, and that the nervous apparatus mentioned conveys those impressions, or is the seat of what he terms nervimotility.

To prove, then, that impressions made at one part of the plant are conveyed to other parts, following M. Dutrochet, I concentrated the rays of light by means of a lens on one of the extreme leafets, and found that immediately afterwards this leaflet, with its fellow on the opposite side, closed; and that the impression was conveyed down the petiole was evident, from the leaflets below closing in succession downwards; then the leaflets of the secondary petioles on each side closed from below upwards, or towards the extremity of the leaf; shewing whence the impression came, and its course. Much about the same time, the secondary petioles supporting the leaflets approached each other in a lateral direction; then the primary petiole bent itself down towards the ground. Sometimes this was all that happened, and occasionally the impression did not go so far; but generally when the sunshine was bright, it was conveyed to the other leaves of the plant, for the most part to those above and below first, then to the next in vicinity; sometimes, however, the impression was manifested first in those leaves at a considerable distance from that on which the stimulus was applied; the first effect on which was the bending of the petiole towards the ground, the next the approaching of the secondary petioles, and, lastly, or about the same time, the closing of the leaflets in pairs, in each of the secondary petioles, from the base towards the extremity of the leaf; the motion being reversed in regard to that in the leaf stimulated. Such, then, were the general effects of the concentration of the sun's rays and other stimuli on the leaves of the sensitive plant. The Mimosa pudica, however, frequently closes all its leaves in the bright sunshine, the primary petiole being then, as far as I have observed, generally in an erect position, the leaflets and secondary petioles only being flexed; the same happens at night, with considerable flexion of the primary petiole; also in cold weather, and on the application of many stimuli. I remember several years ago, being very much astonished at the effect produced by cold water on the Mimosa pudica. During bright sunshine, I poured a quantity of cold water into a plat in which the flower-pot, containing the plant, was standing; immediately after which, the leaves rapidly flexed themselves towards the ground; the secondary petioles and then the leaflets closed. That it was by the roots that the impression was conveyed was evident, from the effects manifesting themselves at the lower part of the stem first, and proceeding progressively upwards. I have tried other stimuli, such as caustic and a heated iron-wire, which perhaps answers best. It is more convenient in experimenting, for it may be had at any time, which cannot be said of the bright sunshine, more especially in this country, and does not destroy the leaves like caustic, it not being necessary to touch, nor even to apply it so near as to scorch them; it also appeared to me to act more certainly than any other stimulus in causing the flexion of the leaves, and its impressions seemed to be generally conveyed further than those of any other. After the application of these stimuli, the leaves became erect, but not for a considerable time, longer or shorter, according to the state of the atmosphere, which appears to have great influence on their action, this being always in most perfection during warm moist weather, and bright sunshine. The leaves, on becoming erect, I have always found as sensitive as before the application of the stimuli mentioned, but Professor Graham has found that this property is completely destroyed, for a much longer period, by the application of the vapour of hydrocyanic acid to the leaves of the plant, than after other stimuli.

The part of the plant which conveys these impressions, M. Dutrochet believes to be situated in the woody fibres alone. I have not repeated all his experiments to prove this, having been unable to procure plants sufficiently large for the purpose, but I performed one, and that in the following way: I removed all the cellular structure composing the external part of the bourrelet, and left only the small bundle of woody fibres in the centre, having previously supported the leaf so treated, with a glass rod. On applying the heated iron-wire or lens to the leaf, after this operation, the impression was conveyed to the other parts of the plant, and the usual consequences of such an application took place, apparently little, if at all, impaired in intensity.

M. Dutrochet, in another experiment, reversed that just described; that is, he removed the central bundle of vessels, and left only the external cellular part of the bourrelet, after which he found, on applying similar stimuli, that these impressions were not all conveyed; but this experiment I have not repeated: it is a very delicate one, and can only be done in large plants.

The next experiments are concerning the organs of motion in the sensitive plant,—as to the kind of motion, it is by what M. Dutrochet terms *incurvation*,—the meaning of which will easily be understood by the following experiments, which I have repeated, tending to prove what part of the sensitive plant it is which possesses this power. He states that the moving power of that plant is situated at the basis of the primary petioles, the secondary petioles, and also at the basis of each of the leaflets. This organ of motion then, which he terms a *bourrelet*, is the little oblong swelling situated at the different places mentioned. To prove that it does possess the powers attributed to it by M. Dutrochet, following him, I removed the whole of the cellular substance of the bourrelet at the base of a primary petiole, leaving merely the central bundle of vessels: it was not every leaf which could support itself after this operation, but a few did so, and the better after the removal of a portion of the leaf, so as to lessen its weight; and it was impossible to excite any motion in the primary petioles of such afterwards, although otherwise the leaf appeared quite healthy, and motion was excited as usual in the other bourrelets. This then proves, that the bourrelet is the organ of motion; and the next question is, How do the flexion and extension of the leaves take place? This is solved by the following experiments:—

I removed the upper half of the bourrelet at the base of one of the primary petioles, with a sharp knife; immediately after this, the leaf, instead of flexing itself towards the earth, which was always the case with those leaves in which the bournelet was uncut, after the same extent of agitation which necessarily arises during the performance of the operation, remained for a time in the same position in which the leaf happened to be when this was performed, but soon began to move gradually upwards, and there it remained stationary while the plant was sufficiently supplied with water; for this, as M. Dutrochet remarks, has a great effect on the motion, which is supposed by him to occur, in consequence of an afflux of fluid to the one or other side of the bourrelet, according to circumstances. The application of a drop of water to the cut surface, in general caused a rapid movement of the leaf upwards, and to a greater extent than usual; and no agitation or stimulus short of such as destroyed its vitality, could cause the leaf, after this operation, to flex itself towards the ground. This experiment, then, proves that the portion of the bourrelet which raises the leaf, is not the upper half, but that it is forced up by the action of the lower half alone.

To shew the action of the upper, I removed the lower half of the bourrelet in the same manner as formerly mentioned, concerning the upper, immediately after which, the leaf bent itself towards the ground, and there it remained, and never rose again, although otherwise quite natural. The descent was always more rapid after this operation than the ascent of the leaves after the removal of the upper half of the bourrelet, as in the former experiment; and this no doubt is caused by the assistance which gravity gives to the force downwards; but it is manifest that there is a force pushing downwards, for, on simply inverting the flower-pot containing the plant carefully, the leaves operated on will be found to be only slightly raised from the earth, the effect of gravity being in such a case reversed. This experiment, then, proves that the lower part of the bourrelet does not cause the descent of the leaf, but that this is confined to the upper half alone, the motion being caused by incurvation downwards, as the contrary is produced by incurvation upwards, in consequence of the occasional turgescence of these parts, excited by the stimuli mentioned. After these operations the leaves remained in a healthy condition for a considerable time, generally for many days, but were rendered less able to bear the heat of the mid-day sun.

The leaves of the Mimosa pudica, like the leaves of most plants, turn themselves towards the light, and this is effected in the plant under consideration by the action of the bourrelet, which possesses a lateral incurvation to a slight extent; and in removing the upper or under portions of the bourrelet, in the experiments described, if the incision happened to be a little to either side, the leaves were invariably twisted upwards or downwards, and to one or other side of the stem.

Such, then, are repetitions of a few of the experiments of M. Dutrochet, on this very interesting plant, and the conclusions to which they lead are quite in unison with those of the author himself. There are many more however, just as interesting, which at some future opportunity I propose to consider.

Additional Remarks on the Climate of the Arctic Regions, in Answer to Mr CONYBEARE. By the Rev. JOHN FLEMING, D.D. F.R.S.E. (Communicated by the Author.)

THE remarks which I communicated in the April number of this Journal, " On the value of the Evidence from the Animal Kingdom, tending to prove that the Arctic Regions formerly enjoyed a milder Climate than at present," were not intended to offend any class of readers, and did not seem likely to provoke any angry discussion. My surprise was therefore considerable, when I found, in the following Number of the Journal, an " Answer" to my paper, by the Rev. Mr Conybeare, in which the author has betrayed a degree of irritation incomprehensible in the peculiar circumstances of the case, and has exhibited such a want of accurate information, sound judgment, and good taste, as to recall the character which Martin Lister gave of certain geologists in his day:—" It is to be observed (says he) where men are most in the dark, there impudence reigns most: they are not content fairly to dissent, but to insult every body else." Indeed the whole character of the paper differed so much from the estimate I had previously formed of Mr Conybeare's attainments, that I was disposed to indulge the hope that he would, upon due consideration, do himself justice by voluntarily avowing the mistakes into which he had been betrayed. His silence, however, has left me no other course to pursue, than the painful one of exhibiting him to the readers of this Journal in a light which will probably fill their minds with surprise, and perhaps his own with mortification.

In the paper which has given rise to this discussion, I attempted to point out the value of Analogy as an instrument of research in Natural History, and the danger arising to geology in particular, from confounding the terms *genus* and *species*. The important question which I proposed to solve, was thus stated:—" Supposing ourselves acquainted with the habits and distribution of one species of a genus, can we predicate, with any degree of safety, concerning the habits and distribution of the other species with which it is generically connected?" In order to proceed with due caution, I investigated the three following conditions:—" 1. If two animals resemble each other in structure, will their habits be similar? 2. If two animals resemble each other in external appearance, will their habits be similar? 3. If two animals resemble each other in form and structure, will their physical and geographical distribution be similar?" The numerous facts which were produced under each of these heads, justified the reply in the *negative*. When I read the title of Mr Conybeare's paper, "Answer," &c. I was at first struck with the boldness of the attempt to outargue demonstration, and did expect that he would have ventured on the examination of the different points I had discussed, and have endeavoured either to disprove my facts, or to combat the soundness of the conclusions which I had drawn from them. I regret to find, however, that it did not suit the tactics of my opponent to pursue so straight a course. He seems to have been aware of the impregnable nature of the positions which I had taken up, and wisely kept at a distance, resolved, however, to practise a little desultory skirmishing, to convince his friends that his spirit is not wholly subdued. To soothe his feelings, by giving him employment, I shall put a few light troops in the pursuit, ordering them to trace *every step* he has taken; fight him wherever he pleases to make a stand; and, should he offer to surrender, to give him honourable terms, not on account of his dignified conduct since the commencement of the campaign, but in consideration of his former good character, and the efforts he has made to *restore* the Eualio Sauri; but, above all, his connection with our esteemed ally, "The Geology of England and Wales."

The first paragraph of the "Answer," begins with what Mr Conybeare probably imagined I would value as a compliment, and ends with a sentence intended for condemnation. In natural history, I am styled "a diligent and meritorious compiler;" while, in geology, my "information is evidently extremely limited."

> Falsus honor juvat, et mendax infamia terret,
> Quem, nisi mendosum et mendacem.

With the value or extent of my compilations from the works of naturalists, or from the book of Nature, Mr Conybeare is in ignorance, as the sequel will demonstrate; and he is in the same state with regard to my geological labours, or the extent of my collection of organic remains. Is it not probable that an individual who permits himself to praise or to censure an author whose works he has never read, may be equally dogmatical in reference to *things* he has not studied? I am censured, at the same time, for presuming to differ from Baron Cuvier, and from all the most eminent names in geological research. I did not expect that my *right* to judge would have been called in question. When the page of Nature is accessible to me, I value the lesson which it yields; and, when backed by such authority, I dare to call nonsense by its true name, even when uttered by a Cuvier or a Conybeare.

My opponent feels himself obliged by the "interests of scientific truth," to object to my "estimate of the value of the evidence derived from the Animal Kingdom, as to the former temperature of the northern regions, as altogether insufficient and superficial." Doubtless it was unnecessary, on the part of Mr Conybeare, to have replied to such a paper, if the author had no authority, and his statements no weight; and still less necessary to make the reply as lengthened as the original, if all he had to destroy was "superficial." It seems, however, that this character attaches to my remarks, because I had been too much under the influence of the inductive philosophy. I had, it would appear, tried the value of the *standard*, in the first place, by a number of particulars with which I was acquainted, and which injured its value, when I ought to have *assumed* the standard as correct, and thereby been enabled to degrade my opposing *facts* to the rank of trifling exceptions. I was so much occupied, it seems, in the examination of the *particulars* of the argument, that I became insensible to the value of its *cumulative* character.

But my object was to prove that the particulars in this *cumulative argument* were of no value, because different species were assumed as identical in *distribution*, when we only knew that they resembled each other generally in *structure*. Now, it is this general resemblance in structure which has induced Mr Conybeare to conclude that *all* the analogies *invariably* lean one way,—all point to the "products of warmer climates as the only beings with which the tenants of our strata hold affinity." Mr Conybeare (as well as many other geologists of reputation who have not attended to the first principles of zoology) does not seem to be aware of the *origin* of this affinity, the character of which, on this account, it seems necessary to state in this place, however briefly. There are *more species* of animals in tropical than in arctic countries, and better collections of *specimens* of these in our public establishments. Whenever, therefore, we attempt to trace the resemblance of a new, recent, or extinct animal to those which have been identified, we may expect to find analogous forms most readily where the species and the specimens *are most numerous.* All this leaning one way may point out *generical affinity*, but, in reference to the point at issue, *the physical distribution of species*, it offers no assistance whatever. My views "of the doctrine of chances," therefore, do not probably differ much from those of my opponent, who does not seem to be aware that he throws with loaded dice, and that the "cumulative" evidence which is cast up, though highly useful to the systematical zoologist, has hitherto betrayed the unsuspecting geologist into error.

I am at a loss to comprehend in what way Mr Conybeare has any right to censure me, on account of the difference of my "geological notions, from the speculations of Professor Buckland." I am not aware of any remarkable difference in geological opinion betwixt us, with the exception of the "diluvian hypothesis." The views of Cuvier, on this subject, I have always considered as erroneous, and I did regret that so acute and energetic a geologist as Professor Buckland should have been deceived by them. The learned Professor's zeal for a favourite vision, led him to provoke me to a reply in the 28th Number of the Edinburgh Philosophical Journal, April 1826,—a reply which my friends assure me gave the death-blow to the diluvian hypothesis. Certain at least it is, that, since that time, with the exception of a very few individuals who may still be found on stilts, amidst the "retiring waters," the opponents of the hypothesis have become as numerous as were formerly its supporters, and the period is probably not far distant, when the "Reliquiæ diluvianæ" of the Oxonian geologist will be quoted as an example of the *idola specus.*

When we examine any genus of animals or plants, we find the species differing more or less in habit. Whatever species we assume as the type, the others will be found varying more or less in form, and in their relation to heat and moisture. If we consider the typical species as limited to a certain isothermal line, others will be found departing therefrom; and in many groups will be found species linked together by external resemblance, yet widely separated by geographical distribution. In every genus, whether limited or extensive, there is a leaning this way, (even in the Palms, to which Mr Conybeare rather incautiously alludes), though this *cumulative* evidence has been strangely overlooked. These plain truths, familiar to every one in the least degree acquainted with the laws which regulate the distribution of animals, constitute the foundation of my argument, though it has been unaccountably perverted by my opponent. He exhibits me as stating that, " because some genera are not limited, therefore no genera are so limited," or " because, in certain widely diffused genera you cannot argue from the habits of some of the congenerous species, to the rest, therefore you cannot argue thus in any genera whatsoever." Now, such views of the subject never entered into my mind; and most certainly I was never guilty of sending such nonsense to the press. The reader will search in vain for it in my paper of April last. It has been said, that, " when a man has the framing both of his own argument and that of his antagonist, he must be a very unskilful logician if he do not come off with advantage." But though the " narrow system of Oxford logic," in which my opponent states that he has " unfortunately been trained," may have dictated to him such a mode of proceeding, common candour should have exercised a counteracting influence; and common prudence should have restrained him from putting on record such a proof of his limited acquaintance with the influence of climate as the following, in which, by a singular mistake, he attributes the habits of the *individuals* of a species, to the *species* of a genus: " Nature has limited by the laws of climate, not only species but genera;" " so that although some stray species may be found beyond the general limits, yet these are very rare, and always attest, by their dwarf size, how uncongenial is their habitation."

Before proceeding to the consideration of what Mr Conybeare supposes to be the proofs of the accuracy of his views, I may notice the censure he passes on my " philosophical boldness," because I ventured to state that Cuvier had boasted too confidently of analogy as a guide; and, because I quoted the resemblance of the sheep and the sow, in the general form of their feet, while a great difference existed in the digestive organs.

Mr Conybeare should have compared the feet of the two species before he ventured to write on the subject. I might have quoted several other examples, from the same source, but I shall at present only supply one other. Cuvier has declared that "the smallest articulating surface of bone, or the smallest apophysis, has a determinate character, relative to the class, the order, the genus, and the species to which it belonged; insomuch, that when one possesses merely a well preserved extremity of a bone, he can, by careful examination, and the aid of a tolerable analogical knowledge, and of accurate comparison, determine all these things with as much certainty as if he had the entire animal before him." Yet in spite of this piece of silly gasconading, the learned anatomist is forced to admit, in reference to the fossil bones of the genus Horse, "It is not possible to say whether it was one of the species now existing or not, because the skeletons of these species are so like each other, that they cannot be distinguished by the mere comparison of isolated fragments." Analogy is thus at fault; for surely remarkable differences prevail in the external appearance, habits, and distribution of the Zebra, the Ass, and the Horse.

We admire the boldness with which Mr Conybeare ventures to proceed from generals to particulars; and he commences by displaying the extent of his knowledge regarding the distribution of the Lamelliferous Polyparia, constituting the genus Madrepora of Linnæus. After all his researches, he has discovered that a single species lives in the seas of Norway, and he triumphantly exhibits this "solitary tenant of colder seas," in contrast with the "hundreds of species inhabiting warm latitudes." (There is a considerable numerical exaggeration here, which I leave to its author to correct.) In a note to this paragraph, he adds, that an English Caryophyllea had been described by Mr Broderip, in the Zoological Journal for April 1828. Mr Broderip, it is true, imagined that "the hard parts of this indigenous species do not appear to have been any where described;" but had Mr Conybeare been acquainted with the history of British zoophytes, he might have corrected this mistake, by pointing out that I myself had published (in the 2d volume of the Wernerian Society's Memoirs) a description of the same species, fourteen years previous to April 1828; and I may add, that Dr Leach saw my specimens so early as 1812. Personally unacquainted, apparently, with the physical distribution of the Lamelliferous Polyparia, Mr Conybeare endeavoured to gain the requisite information, by a process which indicated his incompetency for the task. In order to ascertain the number of species, he consulted Lamarck's Catalogue, (Histoire Naturelle des Animaux sans Vertèbres, we presume), which is not offered as complete, nay, where the author expressly says, " J'ai cité d'un premier jet et presque *sans recherches*, sous chaque genre, tantôt un petit nombre d'espèces, tantôt un nombre beaucoup plus grand." In ordinary circumstances, any zoologist wishing to ascertain the productions of the northern regions, would have consulted those authors in whose writings the species have been described, instead of a confessedly imperfect compiler. Mr Conybeare must surely have heard of the " Systema Naturæ" of Linnæus, where the MADREPORA *ramea* is recorded as a native of Norway, as well as *prolifera*. If he could not have obtained a sight of the " Systema," he might have consulted the " Elenchus Zoophytorum" of Pallas, and he would have found similar notices. But he should not have contented himself with even such compilations. " Lubuit enim integros adire fontes, atque haurire." In the " Prodromus Zoologiæ Danicæ" of Müller, he would have found notices of the following as northern species, *M. interstincta*, *damicornis*, *muricata*, *prolifera*, *virginea*, *ramea*. In the Fauna Grœnlandica of Fabricius, *M. damicornis* and *parasitica* are recorded. Had he even imposed on himself the less irksome task of ascertaining the number of British Species, and ever opened my " British Animals," he would have found three species indicated as natives of our own seas, (p. 598). He would thus have discovered nine species inhabiting the colder seas, instead of his " solitary tenant," and saved himself the pain of owning his connexion with the following flippant remarks: " How will Dr Fleming account for the gradual disappearance of this family in our latitudes? Why does a page of our natural history, once so rich, now present a total blank?"

I have thus redeemed a pledge given at the beginning of this paper, that Mr Conybeare lauded me as a compiler, when he had not at all examined my alleged compilations; and I may now add, that he appears to have been unacquainted with the animals about which he was speculating, and even with the authors by whom they have been described.

Mr Conybeare next passes on to the *Crinoidea.* There is a large species, a native of the West Indian seas, and a species inhabiting our own seas, so minute (surely he has never seen Thompson's figure or description!) "that it cannot be ascertained to belong to the family at all, without a powerful lens." All the fossil species are large, and hence the analogy he supposes is in his favour. But Mr Conybeare should have been aware, since the discovery of the *Encrinus Milleri* of that indefatigable zoologist the Rev. Lansdown Guilding, that there is a small species as well as a large one in the Caribbæan seas, and that in consequence of the facts ascertained by Thompson and Guilding, the *Pentacrinus* and *Comatula* must be united in one group, a circumstance which the frontispiece of Miller's *Crinoidea* might have intimated; and he may, at the same time, be informed, that a large and well developed species of the latter is now before me from North Lat. 73°.

My opponent very prudently passes over the bivalve and unchambered univalve shells, and makes a stand under the protection of the *Nautilidæ.* "The few existing species of this class (he says) are confined to warm latitudes." Where did he learn this dogma, uttered with so much complacency? In Turton's Conchological Dictionary there are 24 species, and in my "British Animals" 39 species of the class, enumerated as natives of our own seas! "Turpe est in patria vivere et patriam nescire."

Having hitherto conducted the chace in a more rapid manner than was probably suitable to the resources of the pursued, we shall slacken our pace for a few moments while we discuss the merits of his arguments derived from Reptiles. Of the *Crocodilidæ,* he says, "This family actually includes many species, and is exclusively limited to warm latitudes." Some of the species are certainly natives of warm latitudes, but there is here a *leaning* observable in some species towards colder regions. The crocodile of the Nile can surely bear a greater degree of cold than the one which inhabits Senegal, though probably less than the caiman of the Mississippi, for, according to Cuvier, "cette espèce va assez loin au nord; elle remonte le Mississippi jusqu' à la Riviere Rouge. M. Dunbar et le Docteur Hunter en ont rencontré un individu par le 32° et demi de latitude nord, quoiqu'on fut au mois de Decembre, et que la saison fut *assez rigoureuse.*" If, then, we have an existing species capable of living in a temperate river, where is the foundation of the claim of the extinct species to be regarded as *exclusively* the inhabitants of warm latitudes? The geographical positions of their remains may be considered as an index of the physical distribution of the species.

" The existing *Chelonians*," says Mr Conybeare, " with a few minute exceptions, are all confined to warm latitudes." He ought to have enumerated these *minute* exceptions, stated the number of species natives of Europe, and the different stragglers which have visited the British shores, aye, the Ultima Thule; and we have no doubt that his pen would never have recorded the passage now quoted.

Mr Conybeare gives " a list of the animal genera actually limited exclusively to warm latitudes, but occurring fossil in this country." He admits that certain genera afford no indications as to temperature whatever, and affects to overlook the value of the evidence which they furnish in determining the laws of physical distribution. But to what extent will his selected animal genera aid him? His first example is the Elephant. This genus is at present confined to warm latitudes; therefore he supposes every fossil species must have flourished in a warm latitude. It is not my intention to repeat the arguments already advanced, to prove the falsity of this conclusion, for the scantiness of Mr Conybeare's zoological attainments prevents him from comprehending their value. But I will introduce him to Baron Cuvier (whom he has designated " the first philosophical authority," but whose writings he does not appear to have examined), who will tell him, in the first volume of his incomparable work " Recherches sur les Ossemens Fossiles," that the extinct elephant or mammoth was not a dwarf; that it had a covering suited to a cold climate, (p. 197); that it *possibly* could support a temperature too low for the existence of Indian species; that it is even *probable* that it was so constituted as to *prefer* a cold climate, (p. 200); nay, so satisfied is Baron Cuvier of the visionary nature of the views entertained by the school to which Mr Conybeare belongs, that he says, " Ainsi toutes les hypothèses d'un refroidissement graduel de la terre ou d'une variation lente, soit dans l'inclination, soit dans la position de l'axe du globe, *tombent d'elles-mêmes*, (p. 206; see also p. 86).

Mr Conybeare closes his paper with the following passage: "I will also add, that the bones of *Cetacea*, which might at first sight seem to indicate a cold ocean, either belong to species resembling those of the Mediterranean (the *Rorqual)*, or to extinct genera (the *Ziphius*), or are considered by Cuvier as doubtful." So far, however, is this state of the case from being a correct one, that Baron Cuvier has enumerated ten fossil species: one is like a species native of the Ganges, a second has no close affinity with any known species, while the remaining eight bear a resemblance to the species at present natives of the British seas! Some of the species referred to by Cuvier as analogous, the Narwal, for example, are not likely, in our day at least, to dwell in the Mediterranean, even under the protection of my opponent.

I have thus replied to Mr Conybeare's paper, when probably I might have been employing myself otherwise to greater advantage. But the interests of truth seemed to require of me to point out the vast difference between confident assertion and the deductions of science; and to attempt to convince my opponent that the physical distribution of animals is "a subject (to reply in his own terms) in which his own information is evidently extremely limited; and yet one without an intimate acquaintance with which, it is impossible to conduct to a satisfactory conclusion the discussions upon which he has chosen to enter."

On a peculiar Noise heard at Nakuh, on Mount Sinai.

It is known from the reports of travellers, that a low sandstone hill, which runs along the east coast of the bay of Suez, about three hours from Tor in Sinai, gives rise to a remarkable phenomenon. Here, where the ridge is about 150 feet high, there is a steep acclivity named Nakuh, facing the coast, from which there is heard to proceed a striking and very penetrating noise. Seetzen, who, in the year 1810, first noticed this circumstance, says that at first it somewhat resembles the tone of an Œolian harp, afterwards that of a hollow top, and lastly was so loud that the earth seemed to shake. To the imagination of the Arabians, it resembles the tones of El Nakuh, a long board, suspended in a horizontal position in the Greek monasteries, and there used instead of a bell, a mode of calling together the devout now nearly prohibited: hence also probably the tale that a monastery is concealed in the hill.

Seetzen, although he has not attempted a full explanation of this sound, maintains that it is produced by the grating of the coarse dry sand along the surface of the rock. This very obvious explanation does not appear to have been considered satisfactory, for we find an English traveller, Mr Gray, who visited this place in 1818, of another opinion. He considers the grating of the sand not as the cause, but as an effect, of the sound, and maintains, in common with some other travellers, that the sound must, from the existence of hot-springs, viz. those of Hamam Faraulm, in the neighbourhood, be of volcanic origin, although he can give no other reason for this opinion.

It is certainly not easy, and probably without experiment not possible, to shew how the rolling or sliding of sand down an inclined plane, could produce the remarkable noise heard at Nakuh. Notwithstanding this, the opinion of Seetzen has been confirmed by Professor Ehrenberg, who, in the year 1823, also visited this remarkable place. He ascended from the base of the hill, over its cover of sand, to the summit, where he observed the sand continually renewed by the weathering of the rock; and convinced himself that the motion of the sand was the cause of the sound. Every step he and his companion took caused a partial sound, occasioned by the sand thus set in motion, and differing only in continuance and intensity from that heard afterwards, when the continued ascent had set loose a greater quantity of sand. Beginning with a soft rustling, it passed gradually into a murmuring, then into a humming noise, and at length into a threatening, of such violence, that it could only be compared with a distant cannonade, had it been more continued and uniform. As the sand gradually settled again, the noise also gradually ceased. From the account of Seetzen, it is also known that this noise is often heard when animals run across the sand; also when the wind blows violently, or when loose masses of rock set the sand in motion.

The sand of Nakuh is rather coarse granular, and composed of fragments of transparent quartz.

On the Constitution of the Territory of Rome, with some General Observations on the Geognostic Character of Italy. By Professor F. HOFFMAN. With a coloured Map.

A. *Peculiarities of the Roman Territory, arranged according to the Differences of the Formations.*

THE rock formations on which Rome stands, are extremely worthy of the attention of the geologist. Few parts of Italy, certainly few of those which have been thoroughly investigated, contain, in so comparatively narrow a compass, such numerous and varied phenomena, and which are of so much importance with regard to the history of this earth; and, if Leopold von Buch, upon these grounds, was justified in saying, on his first examination of this country, that this classical spot was as important to the naturalist as to the historian; this assertion has, since then, been only the more confirmed, since we have here before us a district which has repeatedly, and for a length of time, occupied the talents and acuteness of so excellent an observer. The inquiries of Leopold von Buch himself, the previous incomplete exposition of Breislak, which has been in part set aside by his successors; and, above all, the laborious researches of the meritorious Brocchi, upon the Roman territory, will all be welcome and instructive guides to those who shall in future direct their attention to a subject still by no means exhausted; and the aim of this memoir will be fulfilled, if we succeed in presenting a compressed, but clear view, of the most important geognostical relations discovered by the foregoing naturalists, to the judgment of the reader.

We shall commence with a relation of the individual facts elicited by the labours of these distinguished philosophers; and then proceed to deduce those conclusions to which these elements may lead us. But it will be, perhaps, most in accordance with our design, first to make the following observation.

A single glance upon the form of the surface of the space included within the walls of ancient as well as modern Rome, informs us, that we may conveniently regard this little territory as formed of three quite distinct portions. A broad open valley, intersected by the numerous windings of the river; *on the right*, a high, uniform, and nearly continuous chain of hills, with steep declivities and level summits; *on the left*, on the contrary, a low broken hilly region, the different eminences of which are either completely isolated from one another by different intersecting prolongations of the valley, or constitute long narrow ridges, which terminate in the valley by a soft and gentle declivity.

It is extremely satisfactory to the geologist, that here, as in so many other cases, the differences in the external physiognomical characters of this district, stand in close and intimate connexion with the nature of the rocks which constitute its interior.

Three formations, formed at very different epochs, and under very different circumstances, concur in the formation of the district. Once covered by the sea to a considerable depth, the fundamental rock was formed from the products of the universal ocean;—pierced and ruptured by volcanoes, this received a covering of matters taken from the interior of the earth's crust: and, later still, it was overflowed to a surprising depth by fresh water, which covered it with deposites, partly from a state of chemical solution, and partly from a state of mechanical suspension. It appears, then, most proper to begin with the traces left by the sea, the most general of all these forming powers, on the surface of the district; then pass to the operation of volcanoes; and, finally, conclude with the most local and circumscribed phenomena, those referable to fresh water.

I. *Agency of the Ocean.*

The chain of hills on the right bank of the Tiber, the lengthened ridges of the Janiculus and the Vatican, both mere prolongations of Monte Mario, the highest point of this part, belong, in the most essential part of their mass, to the products of the ancient ocean. The uppermost stratum is a thick bed of a peculiar sandstone. A yellow siliceo-calcareous sand is pretty plentiful at the Vatican, in the garden of Belvidere, and before the Porta Angelica, to the left behind the city wall. It uninterruptedly forms the whole declivity of the Janiculus, on the side next the Tiber, as far as the exposed state of the rock allows us to judge of its internal constitution; and, on the opposite brink, along the wall between the Porta St Spirito and the Port St Pancrazio, fully half the height of the precipice, eighty feet high, in the hollow of the Valle d'Inferno. This sand is often a mere loose unconnected mass, more or less evidently formed of fragments; on the contrary, it is often cemented by the intervention of a basis, into a regular horizontally stratified conglomerate. Brocchi takes notice of a collection of fragments of limestone, in front of the Porta Angelica. According to this author, fragments of limestone and flint, mixed with loose sand, is seen behind the city-wall, between the Porta Portese and St Pancrazio, as also on that part of the Janiculus, where the botanic garden is situate; at the Villa Sante, and in many other places in the vicinity. Leopold von Buch particularly describes similar relations at the Vatican, before the Porta Fabbrica, going up to the Osteria Cruciano. We see here sand and fragments several times regularly alternating with one another, and united by a calcareous, often obviously sparry cement, full of scales of mica, into a fine grained sandstone, and coarse conglomerate strata. The sandstone itself is abundantly mixed with little silver-white and black plates of mica, and is consequently very splendent, and its predominant cement gives it an argillaceous aspect; yet its mass effervesces strongly with acids. In the conglomerates, on the contrary, whose calcareous cement is much purer, we can evidently distinguish fragments of red and white quartz, much greyish-white and blackish-grey Appenine limestone, blood-red jasper, flint, flinty slate. Similar relations are described by the same observer, on the opposite side of the Janiculus, in the above mentioned hollow between the Porta S. Spirito and Porta Portese. The sandstones and conglomerates are here frequently marked by a greater abundance of a siliceous cement, by which they are changed into a *pudding-stone*, of a peculiar appearance, forming pieces which are easily recognised in the working of the sand-pits, by their superior hardness, and which immediately detach themselves. Brocchi informs us also of a solid sandstone bed on the Janiculus, near the wall of S. Pietro, in Montorio; and on the Monte delle Crete; on the Janiculus to the west of the wall, where it is found in company with a very fine breccia, with a calcareous cement. Breislak saw the same appearance on the Monte dei Fornaci, close to the hills of the Vatican. In this superior stratum of our oceanic formation, we seldom meet with *organic remains*; yet they belong, it appears, entirely to the great shell deposite, which covers the summit of Monte Mario, at the Villa Mellini; and in which, according to Brongniart, the most abundant, as well as the most entire, are large oyster-shells, which bear the nearest resemblance to the Ostrea hippopus. The learned Abbate Gismonde also found here a petrifaction, which had been previously described by Brocchi, in his *Conchiliologia foss Subappenina*, a *Patella* of the genus *Emarginula*. Brocchi mentions, that, on digging the foundation for the saloon of the Museum of Pius Clement, a bone was found, which was thought by Brongniart to be the metatarsus of a Palæotherium. The remains of the fossil mammalia, which Brongniart appears inclined to refer to this genus, we constantly found in the environs of Rome, and, according to the express testimony of Brocchi, in the fresh-water deposites.

Under the sandstone there regularly occurs, when we can observe the structure of the rock, a large mass of *bluish-grey clay-marl*. Its fracture is fine earthy and large conchoidal; when moist, it becomes workable, and therefore is a true Figuline marl. It is found uninterruptedly in the hollow which separates the Janiculus from the Vatican, covering both the bottom of the valley and the declivities of the adjoining hills to a considerable height. Brocchi describes it as behind the sacristy of St Peter, on the Vatican, and at the Monte delle Crete, an appendage of the Janiculus. The ancients formerly used the marl of the Vatican for potter's work, as is shewn by the verse of Juvenal (Sat. V.):

> "Et Vaticano fragiles de monte patellas."

Many clay-pits are now sunk for the same purpose, on the Monte delle Crete, and at the Monte dei Fornaci, which discover to us the interior of the mountain. Leopold Von Buch gives us a particular description of it, from which we gather, that the marl has a decidedly stratified disposition, and separates into beds of even a foot and a-half in thickness, which are alternately, dark and light coloured. In its upper strata, the marl regularly alternates with the beds of the above described sandstone and its breccia, which is a proof of its contemporaneous formation. Its interior contains a much greater number of organic remains than the sandstone. Brocchi describes, behind the sacristy of St Peter, numerous fragments of shells, *Dentalia*, *Tellinæ*, and pieces of the cover of the *Lepas Balanus.* There are, likewise, numerous remains of plants, which seem to have belonged to branched *Fuci*; Brocchi also found in it bituminous wood, traversed by slender veins of iron-pyrites. Flaminus Vacca even mentions, that large pieces of it were found in the clay, on digging the foundations of the church of St Peter. On the Monte delle Crete, are also found numerous remains of marine shells, even in the beds of clay which alternate with the sandstone. The same is mentioned by Breislak at the Monte dei Fernaci.

II. *Volcanic Agency.*

If we have seen the heights on the right bank of the Tiber, formed throughout the greatest part of their mass of a marine formation; on the other hand we find, in the hilly country on its opposite side, viz. the seven hills of Rome, and the flat country partly connected with them to the south of the city, the predominant rocks to be the products of volcanic operations. The rock, which is here most abundant, and which forms the main substance of these hills, is a large continuous deposite of volcanic *tuff*, *tufa* of the Italian naturalists, and separated, by Brocchi, from *tofa*—the fresh water deposite. This species of rock, which is so abundant in many parts of Italy, and in the vicinity of every volcano, is distinguished from proper lavas by its never having been seen in the form of a *coulée*, or stream [*].

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[*] The nearest point to Rome, at which true lava is met with, is in the hill of Capo di Bove, two miles from the Porta St Sebastian, where it is quarried, and under the name of Selcea, or Selce Romano, forms the paving stone of the city. It is a true basaltic lava, with a blackish-grey colour sharp-edged fracture, formed, according to Fleuriau's acute observations, of an internally crystallized granular aggregate of augite, leucite, magnetic iron, different zeolites, &c. (Journ. de Phys. 1795, ii. p. 59.) In its cavities are contained many small cubical mellilites, with a white fossil, which appears felspar; and, lastly, zeolites. The whole mass, evidently rests on peperino. Leopold Von Buch believed this hill to stand isolated and unconnected with any active volcano. Breislak concludes from it, the existence of a hypothetical crater, which he thought to have discovered in the midst of the seven hills of Rome; and that its connection with it was destroyed by the hands of man. But the researches of Ricciòli have shewn it to be the termination of a long stream, the origin of which can be traced into the Alban Hills, along the Via Appia, the pavement of which often rests on it.

Within these some years, another locality of this rock has been observed, on

Brocchi, in his account of the geology of Rome, distinguishes it into two kinds, differing essentially from one another.

1*st, Lithoidal Tufa or Steintuf.* Is of a reddish brown colour, with orange spots, owing to pieces of a slaggy pumice-like lava. Its fracture is earthy and almost conchoidal, and is so hard as to be capable of being used as a building stone. It contains white mealy leucites, whose gradual transition into the fresh crystallized substance, has been satisfactorily shewn by Von Buch; scales of brown mica, crystals of black and green augite, and, more rarely, small portions of felspar. Now and then are found round blocks, and angular fragments of limestone imbedded in it. A fine grained variety can be distinguished, which would appear a homogeneous mass, were it not mixed with numerous scales of black and silver white mica.

It usually appears in the form of large beds, from four to six feet thick, traversed by long, vertical, and oblique fissures, which have probably arisen from the contraction of the mass during the process of drying. The fine granular variety, again, has the peculiarity of having a disposition to the slaty structure, on account of the linear arrangement of the scales of mica.

Of the ancient Roman monuments, the Cloaca maxima is built of it, not of *peperino*, as is usually stated; also the part of the under structure of the Tabularium of the Capitol, which is seated on the Hill, whilst its outer covering is of *peperino*. The same hill contains ancient tufa quarries. In the ruins of the passages in the theatre of Marcellus, we see it cut into blocks shaped like bricks; in the same way are formed the squares of tufa in the fortress of the Gætani at the tomb of Cæcilia Metella, and at the corner tower of the new Capitol.

It appears to be the *Lapis quadratus* of the ancients, which the Romans, at least in early periods, employed in paving the streets. Squares of tufa are very often found forming the foundation of the basalt pavement, as is seen in several parts of the city wall: for example, at the Porta St Lorenzo. Of the two kinds of *tophi* which Vitruvius mentions as occurring in Campania, the *Tophus niger* seems to be the black stone of Piperinum, which is used in several of the buildings of Pompeii, but the *Tophus ruber* is the Roman tufa. The place on the Via Flaminia, on the other side of the tomb of Naso, where the tufa was quarried, and which now bears the name of *Pietre Rossa*, was called by the ancients *Saxa rubra*.

In the dwelling-houses are found squares of a greyish yellow tuff, with pieces of yellow pumice, *e. g.* in the ancient cellar of the house No. 66, in the Longara, and in the foundations of the Papal garden, on the way from the Lavator del Papa to the Quartero Fontane. Brocchi did not find this kind any where *in situ*.

The points where this kind of tufa exists within the city walls, are, comparatively few in number. It forms the chief mass of the Capitoline Hill and is here exposed, both by the precipice of the Tarpeian rock, and by the

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the left hand of the road to Ostia, a mile behind the Tre Fontane. It has exactly the appearance of the lava at Capo di Bove, and contains crystals of Gismondi's *Abraxite*, which is most probably a variety of Harmotome. It is rather a mechanical aggregate of volcanic slags, of lapillo, sand, and ashes, which, carried to a distance from the craters from which they were ejected, have been deposited in their present situation.

subterranean galleries, which were formerly used for quarries. On the Aventine hill it appears in the Vigna Lovati, opposite St Prisca, where a quarry has been opened, from which, as Von Buch mentions, were extracted the stones for the foundations of the palace Braschi. The stone here, from its hardness and fracture, as well as colour, resembles bricks so much, that it might easily be mistaken for them, did not we see it rising before us into a precipice 60 feet high. Count Dunin Borkowski has, in his description of this place, compared the lithoidal tufa from the pits of the Monte Verde, before the Porta Portese, with a claystone porphyry. In the Vigna d'Asti, as well as on the Aventine, Flaminio Vacca has already mentioned the occurrence of this tufa, and also round St Saba. It further appears on the Cælian Hill, in the subterranean passages to the east of the church of St Giovanno e Paolo, where are found the remains of an ancient Roman edifice; and not far from thence, at St Giovanni in Laterano, in the vault No. 22. Brocchi, too, saw it on the Esquiline Hill, in the section laid bare by the subterranean passages of the church St Francesco di Paolo, full of fragments of lava, and traversed by variously contorted veins of fatty clay. It is abundant outside Rome, nearer it at Monte Verde than at Ponte Nomentron, Torre Pignatara, before the Porta Maggiore, and, finally, at Ardea, and along the Via Ardeatina.

2*d*, *Granular Tufa, Brockeltuf.* It is very different from the preceding: colour blackish brown, or yellow brown; light; very friable, consisting of large loosely connected grains, with white particles of mealy leucite; fragments of augite; scales of mica, and, at times, containing blackish-grey masses of lava.

With regard to the degree of solidity, texture, and colour, it offers great varieties, according as it is more or less decomposed. It has either entirely the character of *lapillo*, and is only not so dry and less meagre to the feel than that which is now ejected from volcanoes, or it is extremely friable, loses the porous texture, and crumbles down into an earthy mass. It is still more affected by filtrating moisture, which changes it into a kind of clay, which adheres to the tongue; is viscid, and from which the leucite has vanished, whilst the augite and mica remain. It is this same earth which, near Velletri, at the foot of Monte Artemisio, is used for the construction of bricks; and at St Agata, in Campania, between Molo di Gaeta and Capua, for potter's ware. The rude sepulchral urns, at the lake of Carnevoli, in the Albano, are formed of the same volcanic clay.

This tufa sometimes forms a peculiar variety, when it is very much decomposed, which Brocchi calls earthy tuff, *Tufa terroso.* (It is worthy of attention, that what Brocchi calls, in his catalogue *raisonnée*, *Tufa terroso*, is always this, which has been since called Granular Tufa; the lithoidal tufa, on the other hand, corresponds to the *pietroso* of his catalogue. It is of a yellow colour, much lighter, and so friable as to crumble down into a fine powder, which absorbs water with a hissing noise, giving out, at the same time, an earthy smell. Of such a description is especially the tufa described by Leopold von Buch, (ii. p. 31.) This tufa, as well as the former, consists of distinctly separated beds, and appears, like it, intersected by large crevices, which divide it into more or less regular parallelopipeds. At Monte Pincio, and close to the Basilica of St Lorenzo, outside the gate, it presents *impressions of the leaves of land plants*; and, in the latter place, it is pierced by numerous tubular canals, which indicate the previous existence of *branches and stems of trees.* Similar appearances are further seen in a hill at Monte Sacro, at the ancient Via Salara, near the Wine Mountain of the Jesuits; and under the city walls, between the Porta St Giovanni, and the Amphitheatrum Castrense.

With regard to the relations and positions of this species of tufa, the most essential points to be observed are the following: It is, in general, much more extensively diffused than the lithoidal tufa, and forms the principal mass of the *Pincio*, of the *Quirinal*, the *Viminal*, and the *Palatine.* In the environs of Rome it is equally abundant; and all the catacombs of Rome are dug in it, with the exception of those of St Valentino.*

Many points, with regard to its relations, set in a clear light its position with regard to the other formations of this district. Without doubt the most important of these is its occurrence on the heights of the right bank of the Tiber. Here the volcanic rock every where covers the above described marine formation. Leopold von Buch first enumerates a stratum of tufa, six feet thick, on the highest point of the *Vatican*, immediately over the sandstone of the *Osteria crudiano*, at the Vigna of Guiseppe Frangioni. It contains many small pieces of true peperino, round masses of a mixture of augite and leucite, similar to that of the *Rocco di papa* in the Alban Hills; and, more rarely still, small pieces of basalt. Above this, lies a remarkable stratum of portions of an ash-grey pumice-stone, of the size of a walnut, and which floats in water, which may be shewn to extend to pretty considerable distances in this quarter. Just the same, or extremely similar, are its relations, not only at the base of this hill, but also at the *Janiculus.* A greenish-grey granular tufa is here exposed, among other places, at the Porta di Sto Spirito, under the walls of the garden Barberini, and here it covers an aggregate of pumice-stones, cemented by a basis of a whitish tufa. The ridge, which is here separated from the rest of the hill by a little valley, as well as the opposite declivity in the court-room of the Papal court, is almost volcanic. Such rocks also appear on the summit of the Janiculus. Besides, where the different tributary streams of the Tiber have furrowed this elevated plain, a similar succession of strata is seen, as below the Villa Frangioni. A granular tufa, or *T. terroso*, of a brownish colour, is seen right opposite the Porta St Pancrazio, at the upper margin of the hill, in which lie imbedded large pieces of pumice-stone, in a state of good preservation; and also before the gate to the left in the city wall, accompanied by pumice-stone, and pieces of a yellow spongy lava. These are the same strata which extend from here to the summit of

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* These catacombs are the *Arenariæ* of the ancients, which, according to Brocchi, was the denomination, in former times, as well as now, of the puzzolano pits at Frosinone and Segni le Arenare, for the puzzolano earth is nothing else than a variety of this tufa, probably the *Arena nigra* of Vitruvius, (ii. p. 4, 6.) whilst the *Arena rufa*, which occurs in other parts of Vitruvius, is, perhaps, connected in reality with the red puzzolano, which is now esteemed the best, and is found at St Paolo, near the Three Fountains. Both kinds were used for cement in the ancient edifices.

Monte Mario, of which Brocchi (tab. ii. p. 1, 4.) has given a very instructive section. It is principally the *Tufa terroso* which is here predominant.

On the left bank of the Tiber, where the granular and lithoidal tuffs occur together, the latter is superimposed on the former. There are examples of this on the Esquiline, where the subterranean passages of the convent of St Francesco de Paola have afforded a very instructive section; also of the Capitoline Hills under the Tarpeian Rock. Yet Brocchi expressly mentions that this relative position is by no means of regular occurrence. The reverse is seen before the gates of Rome, in the rocks round the tomb of Naso, as well as elsewhere.

There is no undoubted superposition of the volcanic tufa on the marine formation on this side the Tiber. The only point where, in this part of the city, a foreign deposite is found under it, is the singular discovery of Brocchi at the Tarpeian Rock. We there see, in the large subterranean passages of the Hospital della Consolazione, lowermost, a thick stratum of brown micaceous clay, in which a compact limestone of the same colour forms some even beds one or two feet thick. To this succeeds a mass of sand and clay six feet thick, and over it ten feet of granular tufa, above which, to the summit of the rock, is the lithoidal tufa. Brocchi is much inclined to refer the fundamental bed to a marine formation; on the grounds advanced by him, it is certainly very probable. Other local appearances besides this, would indicate that the proper fundamental stratum of the Seven Hills of Rome is a subterranean prolongation of the marine formation, from the right to the left bank of the Tiber. It is the sounding for wells in this part of the city which lead to this general result from a comparison of their depths, although now we can hardly draw any conclusions regarding the strata through which they have been pierced. From Brocchi's observations, which we have collected for that purpose, it follows that the most of these wells, some of which are even placed on the summit of the hill, reach the water almost universally at a depth which comes near to the level of ancient Rome, from ten to twenty feet under the level of the modern city. The volcanic tufa itself can hardly retain the water, on account of its porous structure; and it, therefore, must meet at this depth with a stratum of clay or marl, which prevents its sinking deeper; similar to the strata on the Vatican and Janiculus, whose abundant springs are mentioned by all who describe this place, appear at the surface. The position of the volcanic tufa, with respect to the fresh-water formations, which we will now describe, is also remarkable.*

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* In passing, we may be permitted to touch upon two minerals foreign to the Roman soil, but which, often alternating with the lithoidal tufa, hold an important place in the architecture of the ancients. These are the Gabine and Alban stone. We will comprise both best under the name *Peperin*, (*Peperino*, *Pepperstone*.) The Gabine differs from the Alban only in containing less augite and mica, and consists of a collection of angular pieces of grey and reddish brown lava, traversed by calc-spar, and at times containing small rolled limestone masses. Both it and the Alban Peperino are well distinguished from the Roman tufaceous rock. In the Peperino (says Von Buch) every thing is almost fresh, entire and unbroken, splendent; in the tufa dull, and broken down; the former mere se-

III. *Agency of Fresh Water.*

The plain of Rome, or the portion of the city intersected by the Tiber, and which is bounded by the marine formation to the north, and by the volcanic hills to the south, belongs to the products of stagnant fresh water to a considerable height on the sides of the valley, and pretty far up the lateral valleys which separate the seven hills from one another. These waters overflowed this region at a period when, after the retreat of the sea, and after the cessation of volcanic irruptions, the present river dug its bed. The prevailing substances are loose unconnected masses of clay, sand, and boulders, which were left behind, covering a considerable surface, after the retiring of the water; yet its presence has, in many points, formed a beautiful stone of a firmer consistence, peculiarly characteristic of this country; of which are formed all the ornamental parts of the masterpieces of ancient architecture, and the constant production of which can even now be observed: it has obtained the name of *Lapis Tiburtinus*, or *Travertine*. The argillaceous strata of the valley, whose general distribution has been shewn by the laborious researches of Brocchi, by means of numerous borings, are particularly important on this account, because they cannot be penetrated by the waters which issue forth from the adjacent hills, and are consequently the means of supplying the numerous wells in the lower part of the city. The clay is constantly mixed with a small portion of carbonate of lime, and, as it always effervesces with acids, is a true *argillaceous marl*, (*Marna argillosa*). Its colour is yellowish grey. It is constantly interspersed with small silver-white scales of mica, and contains here and there small pieces of augite and small quartz fragments; it greedily absorbs water; is plastic, and hardens in the fire. Treated with acids, it gives an insoluble residium, which, when not mixed with quartz, is chiefly composed of ferruginous alumina. This clay is useful in pottery work. Brocchi has shewn, that in the most ancient periods use was made of it.

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sembles a porphyry, the latter sandstone, and similarly aggregated strata. The wacke-like basis seldom changes its ash-grey colour. The tufaceous stone at Rome is never so light. Its fracture is fine earthy, but uneven, fine grained, soft; the tufa, again, is almost friable, which is never the case with the lithoidal tufa. Immense numbers of small micaceous scales are found in it, partly as individual black plates, partly as elongated masses, from an inch to the size of a cannon ball. These masses are a collection of micaceous plates, mixed with augite crystals, and often containing magnetic ironstone. Lustre and colour is always wanting in similar plates in the tufa. On the contrary, leucite and augite are more rare in the Peperino than in the tufa, but more frequently small angular white pieces, which are granular limestone.

The Gabine and Alban stone form immense beds, so that they appear one mass; *e. g.* round the Gabine Lake and at Marino. They often include lumps of basaltic lava.

The Alban and Gabine stone is found much more frequently in the ancient buildings than the indigenous tufa. Yet the only certain remnant of the ancient kings is of the latter rock. It appears that later the former rock was preferred on account of its greater fineness, or more beautiful colour. The outer upper walls of the Tabularium are built of Gabine stone.

In several points of the plain, the clay is conjoined with collections of different kinds of sand. It is mostly a yellow calcareous sand, more or less intermixed with argillaceous marl, and at times including limestone fragments, as, *e. g.* was seen by Brocchi in a pit at St. Guiseppe a Capo, No. 11. It is partly, also, a siliceous sand, which is usually limited to the base of the hills, and which, in the plain itself, is only exposed by one pit on the Campo Vaccino, by the side of the Temple of Peace, towards St Francesca Romano. It has also been found on the slope of the Palatine, towards the Colosseum, according to the chart of Brocchi; and it has been met with on the edge of the Cælius, in some pits which were made to find out the ancient Cloaca of the Amphitheatre. The colour of this sand is yellow, with numerous silver-white scales of mica, and pieces of augite. With the aid of the glass, there is visible between the transparent grains of quartz, small white prisms, probably of felspar. It is always mixed with clay, but destitute of any lime. Hence it does not effervesce with acids, and melts before the blowpipe into a black slag. The derivation of this clay and sand from fresh water is principally evinced, according to Brocchi's observations, by our finding in it porous and tubular calc-tuff, containing remains of lacustrine snail-shells. In the sand in the Campo Vaccino, we find the *Helix palustris* and *planata*, Lin., both of which only thrive in fresh and quiet waters. In the calcareous sand, on the sides of the Janiculus, Brocchi mentions the existence of *Cyclostoma obtusum*, Drap. probably the *Helix piscinalis* of Gmelin.

Strata of the same substance are also found in more elevated situations, far above the level of the plain of Rome, which are evidently owing to the same original cause. Brocchi, *e. g.* found an argillaceous marl of a yellow colour, which belongs to this series, on the Capitoline Hills, in the cellars of the Palace of the Conservators, lying on a volcanic tufa. It is here divided into three beds, the lowest of which, indurated and full of augite crystals, also contains many portions of an orange-coloured pumice lava. The others, again, are whiter, and without volcanic fragments. They commonly contain vegetable remains, and bits of the shells of the *Tellina cornea* and *Helix tentaculata*, or *Cyclostoma impurum*, Drap., and their delicate opercula. These remains are more scanty in the two upper beds than in the lower; but the former, again, are richer in concretions of a muddy yellow limestone. In a still more striking manner is the same appearance presented at the Esquiline, in the subterranean passages of St Pietro in Vincoli, where, 140 feet above the Tiber, and above the lithoidal tufa, is a yellow clay, full of calcareous concretions, and rectilineal streaks of a very friable granular tufa, which agrees in all its characters with the fresh-water clay of the plain. There is also seen on the slope of the Aventine, under the bastion of Paul III., opposite the Porta di Testaccio, a bed of a yellow-grey sandy marl, in which are many of the helices of the Campo Vaccino, covered by a considerable deposite of porous calc-tuff.

The Travertino, undoubtedly the most important of all the fresh-water deposites of this region, has been fully and learnedly described by Leopold Von Buch, as it occurs here. It is, for the most part, a chemical deposite of carbonate of lime, which the ancient waters, held dissolved in an excess of carbonic acid, and deposited here, as is often the case at the foot of alpine limestone ranges, where the long agitation of the water, and its extensive contact with the atmosphere, have furnished the conditions necessary for its formation. Even now similar formations are going on in the conduits which supply all parts of ancient as well as modern Rome with water; and where the Anio leaves the Appenines, by the splendid cascades at Tivoli, we have a similar formation, in a great scale, under our very eyes.

The principal masses of this curious limestone lie in horizontal beds and strata. It is yellowish white, of uneven fracture, and earthy grain. On exposure to the air, it gains considerable hardness, and usually assumes that reddish hue which gives so peculiar a character to the monuments formed of it, and contributes, in no small degree, to cause that imposing impression of pomp and majesty which they never fail to excite. Leopold von Buch expressly observes, that what is especially characteristic and remarkable in it, are the numerous perforations and vesicular cavities, from which it is never free. These are of two descriptions of cavities, either elongated and narrow, internally dull, and in which vegetable remains often occur, which shew that they are derived from portions of plants, which have since disappeared; or they are large shapeless openings, which seem to have been irregularly compressed in a longitudinal direction. Their interior is usually covered with calcareous spar, which has the stalactitic and reniform external shape; and at times, when the cavities have again been filled, appear as regular white spots. These openings have most probably arisen from the escape of gases which existed during the consolidation of the stone, as is at present the case in the small Lagune of Solfatara near Tivoli, which has been so often described.

The travertino is rich in organic remains, but never contains marine productions. They are usually vegetable, particularly in the line extending from the Porta del Popolo to Ponte Molle, where many impressions of leaves of trees, traces of branches and seeds, round which the lime seems to have aggregated in concentric layers are found. Every where we see in it the same fresh-water *Conchylia* above noticed as occurring in the sand and clay of this formation. In the district of Torre di Quinto, opposite Prima Porta, Brocchi found it abundantly associated with the femora of animals resembling frogs.

The existence and geognostic relations of the travertino is seen often and clearly exposed within the hills of Rome, and particularly on those at the left bank of the Tiber. The most considerable of these deposites is seen on the declivity of the Aventine, towards the Tiber. It there forms a horizontal bed, at a height of ninety feet above the level of the river, the longitudinal direction of which can be followed in an uninterrupted line for the distance of half a mile. In a pit, which is found within Trelles of No. 14. in the Marmorata, it is distinctly seen above the river-sand; which, on that side again, covers the volcanic tufa of this hill. It now and then alternates with strata of calcareous sand, and includes small pieces of pumice-stone, and likewise the usual remains of vegetables and shells of *Helix decollata* and *muralis*, which are frequently found alive in the gardens of this spot. Over it lies a stratum of that argillaceous clay which we have already seen to be the principal cover of the plain.

Single masses, and even thin beds of travertino, are numerous in the sandy and marly strata, even in the upper ones of volcanic tufa, on the slope of the Esquiline, of the Viminal, and Quirinal; its relations are, however, most striking on the Pincius. We there see, at the church of the Augustines, close to the Porta del Popolo, a thick bed of granular tufa projecting out, in which are masses of cellular travertino, with impressions of reed-like vegetables, and also leaves of the *Populus alba*, *Betula alnus*, and small twigs of the *Tamarix gallica*; there was also found here the fragment of an unknown bone. Over it lies a grey fluviatile clay, with impressions of leaves of the *Salix alba*, and then come those numerous alterations of volcanic tuffs, fluviatile sand, and more or less complete strata of travertino, to a height of more than 130 feet above the level of the river. Leopold von Buch first observed that this was constantly the relation of the travertino to the strata of tuff in this part of Rome, and he has completely demonstrated, that the Pincio forms, in a certain measure, the commencement of a considerable ridge of precipitous travertino rocks, which, on the outside of Rome, are continued uninterruptedly from the Porta del Popolo to Ponte Molle, and in which this order of superposition often recurs. In this rocky ridge are the catacombs of St Valentino, in the vineyard of the Augustines at Papa Giulio, the only ones in the environs of Rome which do not occur in a volcanic rock. Near this spot Leopold von Buch mentions the occurrence in the travertino of distinct impressions of the leaves of the plane tree, chesnut, nut-tree, and laurel.

We shall reserve for the following section what explanations are to be sought of these important relations. Yet here it merits observation, that even on the right bank of the Tiber, the travertino formation is by no means of rare occurrence. We have already seen that it exists outside Rome, at the Torre di Quinto. Leopold von Buch has given a remarkable locality at the chapel of St Andreo. But within the walls of the city are seen many cellular concretions of calc-tuff in the fluviatile sand on the declivity of the Janiculus; and Breislak and Leopold von Buch there found, under the walls of the Villa Pamfili, in the granular tufa itself, a piece of travertino enclosed, in which were found well-marked *Helicites*.

B. *Conclusions from the Geognostic appearances of the Roman Territory.*

In the foregoing exposition of the facts, which an attention to the constitution of the Roman soil presents to the intelligent observer, it was our intention, as much as possible, to limit ourselves to the space included within the walls of the city. The wish to explain the appearances, and, as much as possible, to connect them with the relations of this territory, necessitates us to leave these limited bounds, and to give a glance at the structure of the Italian Peninsula.

Italy, traversed with slight exceptions, throughout its whole length by the gigantic ridge of the Appenines, is naturally divided into two nearly equal halves, but of essentially different constitutions. As far as we yet know, the chain of the Appenines, throughout the greatest part of their mass, is a uniform limestone range, of great thickness. The steep rocky walls of *Tivoli*, which rise immediately from the plain to the height of 2000 feet, are formed throughout of the same light grey compact limestone, with few petrifactions, which forms on the one side the mountains of *Pesaro* and *Urbino*, and on the other side the plains of *Apulia*, as far as the point of *Otranto*. According to the comprehensive description which Brocchi* has given it, this limestone is decidedly a member of the secondary or flœtz series; it is identical with that of the opposite shore of Dalmatia, and with the southern chain of calcareous Alps, which bounds the plains of Lombardy, along the districts of *Como*, *Bergamo*, *Brescia*, *Verona*, *&c.* and, which Breislak (Geologia di Milano) has described in the hills of *Brianza*, in the plain of *Milan*. On that account, it most probably belongs to the Jura formation, and in part to the chalk series; which, as it is the newest, so is without doubt the most extensive and thickest of all the secondary formations on the surface of the earth. In its north and south part; in the Tuscan territory, and even in the more northern part of the States of the Church; as well as at the opposite extremity in the mountains of *Calabria*; this extensive secondary deposite is seen reposing on undoubted transition and primitive rocks. These fundamental rocks, the basis of the high mountain chain, all appear on the Mediterranean side, and therefore bound the flœtz formations on the side opposite to the Adriatic Sea. But this relation is by no means confined to the two extremities of the Italian Peninsula, but even in the intermediate districts it has a considerable influence on the formation of the country, the more exact knowledge of which we owe to the talents and industry of the celebrated Brocchi. According to him, it is a general rule in this region, that wherever the hilly plains on the Mediterranean side expose the basis of the country, more ancient rocks appear immediately at the surface, uncovered by the Appenine limestone. Here the shore of the sea of Liguria, where the transition mountains stand in evident connexion with the principal mass of the Appenines, the members of this formation are almost every where seen on the Tuscan coast, opposite to the primitive rocks of Elba. In the States of the Church, the existence of more or less decided transition rocks are first noticed in Brocchi's *Catalogo Racionato*, in the vicinity of *Ronciglione*; also between the hills of *Cimini* and *Monte Fiascone*, near *Viterbo*, between *Civita Vecchia* and *la Tolfa*; and, lastly, from the subinsular rocks of the *Capo Circelo* to *Teracina*. On the neighbouring *Ponza* isles, the existence of transition limestone has also been lately demonstrated.* But on the opposite or Adriatic side of the central range, these remains of older formations are entirely wanting. We must, therefore, view the Appenine chain, as, indeed, all the mountain chains on the surface of the globe, according to the general views of Leopold Von Buch, as raised from rents in the crust of the earth, and even perhaps, on account of the geognostic constitution, as the gaping margins of such gigantic fissures themselves. It is therefore clear, that the raising cause must here lie much nearer the surface on the western than on the eastern side of the central chain. This idea of the mode of formation is certainly confirmed by what all have observed, the unequally steep declivity of the Appenines on their S. W. side. Further, the reason follows immediately from this, for the breaking out of the numerous volcanoes of this country, only in the space between the mountains and the Mediterranean, never on the opposite side. In the latter situation, the enormous pressure of the Appenine limestones on the fundamental rocks; but in the other, free from this cover, they can more easily give vent to the subterranean expansive powers. But before proceeding to the special examination of these relations, it will be necessary to view these points a little closer.

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* Conchiliologia Fossile Subappenina, i. p. 23–33.

The space which lies between the lofty secondary ridge and the sea-coast, is, on both sides of the Appenines, much broken, and covered by extensive masses of a sandstone and marl, of very new formation. The immense masses of marine remains of well preserved shells, which, in many cases, have scarcely lost their colour and animal matter, of large cetaceæ, &c., which exist in this extensive formation, have already, in many places, attracted the attention of naturalists. Brocchi was the first to collect them in his classical work, under one formation; and to give to the space covered by them the expressive name of the Sub-Appenine Hills. We see, from the description which he has given, that these hills, on the Mediterranean side, commence in the territory of Lucca, and after some interruption in the kingdom of Naples, terminate at the southern point of Italy, near Reggio, in Calabria. The *marine hills* of the right bank of the Tiber, at Rome, the *sandstone* and *marl* of the Vatican and Janiculus, forming the oldest deposites of the Roman soil, entirely belong to the members of this new formation. The comparisons collected by Brocchi shew, that, in their internal constitution and organic remains, they completely agree with other points of the same nature in Italy. The height to which they reach on the Monte Mario is not unusual; for on the hill where the little republic of St Marino is situated, strata exactly similar occur, according to the measurement of Saussure, to a height of more than 2000 feet above the level of the sea. The determination of the period of formation of these strata can be made with greater exactness. They must have been first deposited after the first elevation of the secondary chain of the Appenines had already taken place; for in the interior of the latter, no trace of them is found higher than the elevation just mentioned. They every where cover, wherever they exist, as well the Appenine limestone as the older formations, in an unconformable and overlying position. Brocchi has, therefore, ranged them under the *Tertiary formations*; and this position has been since confirmed by the examination of the organic remains. Prevost endeavoured to show that they may be compared to the upper member of the Paris *Calcaire grossiere*,*—a view which has been since established by Brongniart, after he had examined this district, in conjunction with Brocchi.

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* At Capo Negro on Jannone. Compare Geological Trans. Second Series, Vol. II. Part II. p. 220, Plate xxv. Fig. 6.

The fragments of older rocks which form the sandstone and rolled masses of the Janiculus, and its prolongations, are, as Leopold von Buch has already observed, all derived from the nearest Appenines, brought hither by those enormous marine inundations which once washed the foot of the mountain chain to a considerable height. These remarkable masses were formed, independently of the present arrangement of the valley of the river; and the subsequent course of the Tiber in the valley of Rome, has evidently been determined by the then existing inequalities in the ground. Yet, before the fresh water deposites, the products of volcanic agency appeared in the basin of the ancient sea. The volcanoes of Italy, whose general relations to its structure we have already touched on, succeed one another from the frontiers of Tusany, in an evidently continuous line, which here, as in so many cases, runs parallel to the nearest range of mountains.*

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* Description Geologique des Environs de Paris, p. 792.

The environs of Rome lie between two of the most remarkable centres of these volcanic ridges, all of which, with the exception of those in the Campanian fields, have been extinguished long before the appearance of man in this country. In the N. or rather in the N.W., the trachytic *Monti Cimini*, between *Viterbo* and *Bolsena*, and with them the extinguished craters of *Bracciano* and *la Tolfa*; S.E. the basaltic Alban Hills, with the heights of *Frascati* and *Marino*, and the ancient craters of *Albano* and *Nemi*.

The changes which have happened to these mountains in the formation of the Roman soil, must be of later date than the formation of the tertiary deposites. It is certainly a striking fact, for which we are indebted to Von Buch, that in the sandstone heights near Rome, among the numerous fragments they inclose, we never meet with the productions of the Alban Hills. In vain do we look for pieces of lava, tufa, peperino, or similar appearances, which are yet frequently scattered on the declivities of these hills. Every where here, as in the rest of Italy, the masses of volcanic tufa, ancient lava streams, and the innumerable minerals which derive their origin from subterranean fires, are always met with on the strata of the Sub-Appennine Hills, according to the authority of accurate observers. We have already shown, that at the Janiculus and Vatican, and probably also at the foot of the Tarpeian Rock, and uniformly under the covering of the Seven Hills, *every where undermost is the marine formation, and spread over it the volcanic products.*

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* Breislak limits the volcanic district which is in most intimate connexion with Rome, to the space between the heights of Radicofani and the Alban Hills; and it was for a long time believed that the volcanoes of Latium were completely separated from those of Campania. On the other hand, it has been only lately shown by Brocchi, that the volcanic line is not interrupted, as it appears, at the point where the Appenine limestone reaches the Pontine marshes. He traced numerous vestiges of volcanic rocks through the valley of the Herniker, and found here the chain of the Appenines cut right across by the rectilineal fissure, which traverses the upper part of the Gavigliano.

The opinions of geologists are not so unanimous on the peculiar causes and relations of the formation of this rock within the walls of Rome. Breislak has advanced upon this point a very surprising hypothesis. He imagined, from the form of the Seven Hills, it might be inferred, that, formerly within the walls of Rome, and in the Forum itself, a crater existed, from which were expelled the surrounding igneous products. He even believed he had discovered small lateral craters on the outermost hills of the Aventine, and in the *Intermontium of* the *Capitoline;* and he saw in the tufa of these hills, which we have just regarded as a mechanical aggregate of volcanic matters, nothing else than a lava which had really once flowed. The grounds on which its proposer endeavoured to support this singular view have been lately refuted, from a consideration of the district itself, by Leopold von Buch, and Brocchi. A glance at the improved chart of the city, and especially at the excellent plan of Nolli, on which both these philosophers based their observations, compared with the chart which Breislak has appended to his work, plainly shows how arbitrary and rash changes we must admit, in all the details of this district, in order to give the form of a serrated crater to its present appearances. Further, it has been demonstratively shown, that the *tufa* found here is *not a lava.*

Breislak views it as a crystallized granular aggregation of heterogeneous fossils; but Von Buch has given it as his express opinion, that its constituents are never so sharp and regularly connected, as would happen from a crystallizing process on the spot. They bear numerous traces of abrasion on the surface, which they must have experienced on being brought from a distance. For example, this is well seen in the numerous leucites which have completely lost their fresh appearance, and, by a gradual change from the exterior to the interior, have crumbled into dull, mealy spots. How can he reconcile the constantly stratified disposition of this tufa,—the occurrence of thin layers of alluvion,—the evident intermixture with rolled pieces of volcanic and foreign rocks, of which we gave many examples,—how can we reconcile all this with the supposition of its once having been in the state of a red hot stream? These numerous relations rather lead us to the view, that the volcanic constituents of the tufa have received their present properties through the medium of water. In fact this is the view embraced by both the above mentioned philosophers.

Was it, then, the oceanic water which produced the tufaceous covering of the Roman soil, or did it arise from terrestrial fresh water? Von Buch seems inclined to the latter supposition; and, indeed, the grounds which he advances would be decisive, if the formations which we are considering were confined to Rome. Tufa and travertino, which are so undeniably fresh water deposites, are here, as we have above seen, often irregularly alternating with one another. Almost all the hills of Rome show examples of tufa strata resting on regularly deposited travertine, and what we admit of one of these deposites cannot be refused to the other. "The formation of these two rocks, so different in external aspect, composition, and structure, must, notwithstanding, be viewed as contemporary." These are the words of this gifted naturalist. The view, on the contrary, which Brocchi has adopted to account for the manner of formation of this volcanic tufa, excludes entirely the operation of fresh-water, and it is certainly deserving of strict examination the grounds on which this talented observer rests his positions.

Undoubtedly it is of importance, in the first place, to consider that the tufa-covering of Rome is not entirely isolated in the district of the Italian volcanic zone, but is regularly extended from the mountains of St Fiora, in Tuscany, through the Romagna into the plains of Campania, into the vicinity of Vesuvius, and the Phlegrœan fields. Such an uniformity in a stratum formed through the medium of water, of such an extent, certainly requires as great an extension of the water which produced its deposition and consolidation. Fresh waters could not have easily produced such relations. This tufa is, further, found even in islands and regions quite destitute of fresh waters, or where, at least, they are very scanty; so Brocchi found it on *Ischia* and *Procida*, which have no rivers; it has lately been discovered on Lipari by the researches of the well informed traveller, Mr Ruppel; and, in Sicily, the tufa is seen in the *Val de Noto*, where rivers are very scarce. But still more indubitable evidence exists in the numerous organic *marine remains* which the tufa now and then encloses to a considerable height, and of which Brocchi has taken notice in many points. Among others, there was found in the Peperino, in a layer of pumice-stone, mixed with granular tufa, 2½ miles from *Montallo*, on the road from Corneto, many pieces of the shells of the *Venus islandica*. Nearer Rome, at Aqua Traversa, on the other side of Ponte Milvi, shells of sea-mussels occur in beds of tufa, alternating with a loose sand. On the summit of the Monte Cavo, in the Alban Hills, well preserved *Bivalve Murices* have been dug out of a dark volcanic earth. Sea-bivalves are found near Velletri, in a tufa stratum, which covers a lava stream, some of which are preserved in the museum Borgia, and no less numerous are the examples of such appearances in the Phlegrœan fields, on Ischia and in Sicily.

Since the Italian volcanoes have been raised above the sea, they have no longer formed tufa masses, which can at all be compared with the oldest covering of the volcanic regions. Even the well-known tufa, which envelopes *Herculaneum*, is of very slight cohesion, which it first received by moisture and pressure; and besides this, Lippi has distinctly shewn it to have arisen from alluvions. Brocchi thinks that, on that account, he may conclude, that the tufa-covering was especially the work of submarine volcanoes, or of such whose products were taken and carried away by the sea. He rests his opinion upon the known example of the elevation of an island with an irruption of pumice, mixed with sea-shells, at Santorini, in the Archipelago, to which we might add many which have been observed since. Von Buch, too, considers this view as admissible, from what he says at the conclusion of his treatise on Mount Albano:—“ Perhaps Peperino is to be explained as a repeated irruption of ashes, which were much diffused, fell into the sea, and there assumed a stratified form. With these ashes were ejected, from the interior, the basalts and limestones which are now enveloped in the Peperino."

The same is expressed by this naturalist, when, in another place, he observes, on the great extent of the pumice of the Vatican as far as the vicinity of Civita Vecchia:—"But what other agent than an universal water, without any violent agitations, could have extended these horizontal strata over such a space?"

But to what is owing the singular reciprocal mixture of travertino and tufa strata, which we have mentioned above? Brocchi has explained himself on the point, and, as we think, satisfactorily. He esteems it probable, that all the tufas, which either rest on travertino, or contain fresh-water products, are no longer in their original condition. They must have been deposited in their first position by the same waters, which brought together the constituents of the travertino, and have subsequently been united by the chemical operation of the dissolved substances.

We must, therefore, according to Brocchi, distinguish the *Tufa originale* and *tricomposto*, since both are extremely similar in their external characters, and can only be separated by the relations of their position. Yet we must observe, what is of undoubted interest for the history of the Roman territory, that even, according to Brocchi's very industrious researches, the matrix of the Roman tufa has not, as might be at first imagined, been in the Alban Hills. It must rather be sought, with more probability, in the more distant *Monti Cimini*, and in the hills round the *Lago di Bracciano*. On this he has often observed, in his *Catalogo Racionato*, that the present existence of pumice-stone, in the tufas at Rome, is evidently at variance with their origin from the hills of Albano and Tusculum. These volcanoes, as Gmelin has already observed, have never produced any pumice; and we do not find in them the Roman lithoidal tufa, but constantly the peperino, which is foreign to Rome. According to the opposite authorities, a lithoid tufa extended itself from Rome, of which the Roman is only a slight variety, to far beyond the hills of Cimini. It is reddish brown, or reddish yellow, contains felspar, and large pieces of orange-coloured slaggy pumice lava, which the Roman tufa only contains in very small fragments. It is even the universal rule, that the minuteness, and also the firmer cohesion of the ingredients, generally go together, the more we approach it on the N.W. to the hills of Rome, where this mass seems to terminate.

If we have hitherto required, for the explanation of the geological phenomena presented by the oldest formations of Rome, and the volcanic cover which succeeds them, a distribution of the sea and land different from the present; yet, on the other hand, in the newest strata of Rome, in the *formations of marl* and *river sand*, and in the thick *beds of travertino*, we meet with evidence of a state of things, which, in local limitation, comes very near to the present constitution of the country. The volcanoes of the neighbourhood were extinguished then, as well as now. When these strata were formed, the internal commotion of the earth's crust had already ceased, the sea had nearly retired within its present bounds, and perhaps its last ebbings had contributed to excavate the broad furrow of the principal valley, and of its lateral ones. The great basin of the Tiber, as well as the lesser valleys which separate the hills of Rome from one another, were also covered by these fresh-water formations; the former must, therefore, have existed previous to the production of the latter. The condition of organized beings must have been the same as at present; for the remains, which once lived in them, agree completely with those now existing on the spot; yet the formation of the valley could not be quite completed, as is indicated by the extension of fresh-water formations into places which they could no longer reach. The Tiber, in times previous to the historical epoch, must have been elevated more than 130 feet above its present level. The circumstances of its flow must have also been different in ancient times. The modern Tiber forms neither marl nor sand, for the level of ancient Rome neither covers, nor does it shew, a stone which can be compared with the Travertino. The shell remains, which exist in these formations, are never those which thrive in its bed; they have all been inmates of stagnant, or very slow flowing waters. The river water must have, therefore, formerly existed in a still state to a much greater extent. The stream has been once a lake, of whose former existence, indeed, all observers speak, who have noticed this region even in a general way.

Leopold von Buch, among others, says,—" Every step upon the Roman plain plainly discovers to us traces left by this great lake;" and, in another place, he shews, upon undisputed grounds, that it was just the quiet nature of the deposition, which distinguishes the ancient travertino from what is now deposited in pipes and water-conduits.

Breislak has, besides, expressly shewn how the formation of travertino, which is still going on under our eyes in the small lagunes of the Solfatara, and in the *Lago di Tartaro*, at Tivoli, only presents, upon a smaller scale, the same appearances which once took place in greater magnificence upon the plain of Rome. Yet we cannot forget, that the evidences of a more violent motion of the water of the river, at this period, are in manifest contradiction with these phenomena. They are founded on the numerous large *boulders* of limestone aud basaltic lava which are here and there met with on the travertino, at considerable elevations: for the modern Tiber can no longer roll so far down its bed such masses. Brocchi's observations have shewn, that it deposites its large pebbles at Gavignano and Filacciano, 30 miles from Rome; and from thence to its mouth only, the well-known yellow fine sand, from which it obtained from the ancients the name of Blonde:—

> " In mare cum *flava* prorumpit Tibris *arena*."—Ovid. Metam. xiv.

Leopold von Buch is inclined to seek for this former higher elevation of the fresh waters, in the imperfect retreat of the sea; and Brieslak, as well as Brocchi, follow him in this supposition. But we neither know whether the present state of things could have terminated suddenly (and perhaps this quick diminishing of the level of the water was the cause of the rolling down of these fragments); nor do we know what change this last convulsion can have wrought in the constitution of the region. We must admit that we want the knowledge of many considerable circumstances in order to explain satisfactorily the numerous geological phenomena presented by Rome; and we may conclude these observations with the words once used by Leopold Von Buch, that we are very far from believing ourselves capable of raising the veil, which may yet long envelope these ever-memorable regions.

NOTE.—This Memoir of HOFFMAN will appear in a great work, at present in the press, on the Geology, Antiquities, &c. of Rome, by the Prussian Ambassador at Rome, M. BUNSEN. It was communicated to POGGENDORF for his excellent Annalen, from which it has been translated from the German by a young friend, for this Journal.—EDIT.

On the Different Colours of the Eggs of Birds. By M. GLOGER.

It is a remarkable circumstance that the birds, whose nests and eggs are more exposed to the view of their enemies than those of other animals, lay eggs, the colour of which is scarcely distinguishable from that of surrounding objects, by which the eye of rapacious birds or other animals is deceived; while the birds, whose eggs are of a bright colour, and consequently capable of attracting notice, conceal their nests in hollow trees or elsewhere, or leave their eggs only at night, or continue to sit upon them from the period of parturition. It is to be observed also, that in the species whose nest is exposed, and in which the females take charge of the eggs, without the males troubling themselves about them, these females are commonly of a different colour from the males, and more in harmony with the tints of surrounding objects.

Nature, says M. Gloger, has therefore provided for the preservation of the species whose nest is exposed to the view, by giving their eggs a colour incapable of revealing their presence at a distance, while she has been able, without inconvenience, to give the most lively colours in those cases where the eggs are concealed from sight. It would have been more correct to say, that a certain number of birds can deposite their eggs in places accessible to the view, because the colour which their eggs have renders them liable to be confounded with surrounding objects; while other birds have been obliged to conceal their eggs because the brightness of their colours would attract their enemies. But in whatever way it may be accounted for, the fact exists, and the author, who in his memoir has taken a view of all the birds of Germany, has convinced himself of it.*

Eggs may be distributed into two series, according as their colour is simple or mixed. The simple colours, such as white, blue, green, and yellow, are the brightest, and consequently the most dangerous for the eggs.

1. *Pure white*, the most treacherous of all colours, occurs in the birds which nestle in holes, as the woodpeckers, wrynecks, rollers, bee-eaters, king's-fishers, snow-buntings, robins, water-ouzels, swallows and swifts. It is only in these species that the eggs are of a shining white.

The eggs are also white in some species which, like the house swallow, certain titmice, the wren, &c., construct nests, whose aperture is so narrow that their enemies cannot see into them.

White eggs also occur in species which leave them only at night, or at least very little during the day ; of which kind are owls and hawks.

Lastly, this colour is met with in those which lay only one or two eggs, and which sit upon them immediately after; as pigeons, boobies, and petrels.

2. The *pale green* or *pale blue* colour is found to be peculiar to the eggs of many species which make their nest in holes, as starlings, saxicolæ, fly-catchers, &c.

In the second place, this colour is common to the eggs of birds whose nests are constructed with green moss, or at least placed among grass, but always well concealed ; for example, the hedge-sparrow and blue-throated warbler.

Lastly, green eggs are met with in several large species capable of defending themselves against the attacks of enemies, such as herons.

3. A slight green colour is observed upon the eggs of several gallinaceous birds which lay among grass, without making a regular nest, and which is presently concealed by the great quantity of eggs which they lay ; as in the partridge and pheasant.

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* The memoir, entitled "Uber die farben der Eier der Vogel von Herr C. Gloger," is inserted in Erster Band, 6tes Stück of the Verhandlungen der Gesel. Naturf. Freunde zu Berlin, 1829.

The same colour is also observed in many web-footed birds, which cover their eggs when they leave them, and which are moreover careful to look after them; as swans, geese, ducks, divers, &c. The eggs of certain large birds which nestle in the open air, are even of a muddy white, as is observed in vultures, eagles, and storks.

Among the party-coloured eggs, there are distinguished those which have a white ground, and those whose ground is of some other colour than white. The eggs which have a white ground are those of the golden oriole, the long-tailed titmouse, the nut-hatch, creeper, chimney-swallow, &c. Most of their eggs are concealed in nests that are well covered. The party-coloured eggs, whose ground is not white, at least not pure white, are those of the lark, titlark, some wagtails and buntings; those of crows, shrikes, thrushes, quails, and most of the singing birds, in which the colour of the interior of the nest accords with that of the eggs.

On the Chemical Nature of Equiseta, or Horsetails.

EVERY body knows that the Equiseta or Horsetails, which are rough plants covered with asperities, are much employed for polishing wood, metals, &c., and for scouring culinary utensils. But it is probably less known that these plants are not less remarkable in a scientific point of view than with reference to the arts. Their singular structure, which completely separates them from all other vegetables, has given rise to interesting researches on the part of botanists, among which we must assign the first rank to those which M. Vaucher has published in his Monograph of the Equisetaceæ. Natural philosophers have also made some curious observations on these plants, such as the examination of the remarkable optical properties possessed by the small crystals which the microscope discovers in their dried tissue.

It was therefore to be desired, that chemists should also examine the equiseta, and make known to us the elements which enter into their composition. Accordingly, M. Braconnet has engaged in this kind of investigation; and it is from a memoir on this subject, which he has published in the *Annales de Physique et de Chimie*, Sept. 1828, that we extract the table which contains the analyses of the ashes of some species of the genus Equisetum. The great quantity of silica which these ashes appear to contain, and which exceeds the half of their weight, is a remarkable fact, when we consider it in its relations, whether to the mechanical properties of the equiseta, or to the optical properties possessed by the small crystals with which their surface is sometimes covered. The presence of silica in such large proportion is also in accordance with the observation of M. Braconnet, that the equisetaceæ grow only in very siliceous soils, almost entirely destitute of carbonate of lime. But how is this great quantity of silica itself dissolved, in order to be introduced into the tissue of the plant? This is one of the subjects which has especially occupied the attention of the author. To form a correct idea of this particular point of inquiry, it is necessary to read the memoir itself. We shall here only remark, that potash does not contribute, as might be expected, to produce this solution, for the ashes of these vegetables present the curious, and perhaps unique, fact, of not possessing alkaline properties, or only in a feeble degree in some cases.

Composition of the Ashes.

Names of Equiseta.	Ashes furnished by 100 parts of dry plant.	Silica.	Sulphate of Lime.	Sulphate of Potash.	Chlorure of Potassium.	Carbonate of Lime.	Magnesia.	Ferruginous phosphate of Lime.	Potash in part united with silicious acid.
Equisetum fluviatile,	23.61	12.00	3.39	2.83	2.72	1.46	0.66	0.55	.0
E. hyemale, . . .	11.81	8.75	0	0.33	0.28	0.93	0	0.80	0.72
E. arvense, . . .	13.84	6.38	0	0.37	0.22	5.51	0.46	unde.	0.30
E. limosum, . . .	15.50	6.50	3.3	2.20	1.20	1.50	0.3	do.	

On Parasitic Animals, and on a new Genus of that Family.

Amongst the intestinal worms or parasitic animals, there are some which have at the lower surface, or at the posterior extremity of the body, one or more cup-shaped organs, more or less similar to those which are observed upon the arms of polypi, or at the posterior extremity of the body of leeches. Some naturalists have derived from the number of these organs the names which they have given to the animals bearing them; but, as if they had taken them for mouths, they have made up the names from numerical titles, and the word *stoma*: thus, *distoma*, *hexastoma*, *polystoma*. M. Cuvier himself, having discovered, twenty-seven years ago, in the Mediterranean, a species of this family, which has three cups, conformed with the established custom, and named it *Tristoma*.

It is now well known, that the organs in question are not more subservient to the imbibition of food than those of similar form which the polypi and leeches possess. The animal employs them only for fixing itself, and, with a little attention, the true mouth is always found, which is single, and very different from the cups.

The expressions *distoma* and *polystoma* are therefore improper; and the great inconveniences resulting to natural history from the perpetual changes in names, alone induce M. Cuvier to prefer them to those of *hexacotyles*, and the others which M. de Blainville has proposed, and which more correctly represent the organization which they ought to designate.

Be this as it may, the animal presented to the Academy by M. de Cuvier belongs to the group of parasites, but is infinitely more polystomatous or polycotylous than any hitherto described. Most of these animals are small, several of them microscopic; but this is four, five, or six inches in length. It has upwards of a hundred cups, and if, in naming it, the same method is adopted as with reference to the others, it should be called *hecatostoma*, or *hecatocotyles*.

What adds more to the singularity of its conformation, is the singularity of the abode which it has chosen, or which has been assigned to it by Nature. It lives in the abdominal cavity, or even in the substance of the flesh of the polypus, the only animal which surpasses it in the number of cups with which it is furnished.

M. Cuvier remarks how favourable this circumstance is to the metaphysicians who amuse themselves with composing the intestinal worms all of a piece with the elements furnished by the body of the animals which they inhabit. Here we have the body of a polypus, which has for its parasite a worm, so like the arm of a polypus, that the illusion cannot be greater. Of the two polypi which he produced before the Academy, there was one in which the *hexacotyles* was attached to one of the arms, which it had even nearly destroyed, and which it seems in such a degree to replace, that at first sight it might be taken for the arm itself. "Let it be judged," said M. Cuvier, "how many theories might be founded on such an extraordinary resemblance. Never has the imagination been exercised on so curious a subject. As to myself, who have long adhered to the exposition of positive facts, I shall at present confine myself to making known, as accurately as possible, the exterior and interior of our animals."

Natural History owes the discovery of this worm to the attention of M. Laurillard, keeper of the Anatomical Galleries of the Museum of Natural History, who having been sent to Nice to collect the fishes of the Mediterranean, at the same time engaged in examining and collecting all the other productions of that sea, so rich and as yet so little known.

He found this worm on the *Octopus granulatus* of M. Lamarck. Neither the Octopus vulgaris, nor the Eledone, nor any other cephalopodous animal, was observed by him to furnish any, although he carefully examined them for that purpose; so that the Hecatocotyles would seem to be peculiar to the Octopus granulatus.

Of five individuals which fell into the hands of M. Laurillard, there were three in the cavity of a single octopus, with the head attached to some part of its interior, and the tail stretching into the abdominal sac, but without penetrating into the peritoneum. A fourth was found in another octopus, but in a similar position. The fifth alone was attached, as we have said, to an arm of the octopus, and had transformed itself into a kind of bag into which it had introduced its head, the rest of its body remaining free at the exterior. The hecatocotyles is, therefore, properly speaking, but a semi-intestinal, or rather a semi-external parasite, like the polystomæ and trystomæ, and like the lerneæ and chandracanthi. It is easily detached from the animal on which it lives, and immediately swims about in the water, or climbs upon any solid surface that may present itself, without seeming to suffer much from the change of position. It fastens itself strongly, by means of cups, to the fingers or to any other body, imitating in this also the octopus its patron, this being the most appropriate term for the animal which a parasite devours.

Here M. Cuvier gave an anatomical description of the animal. Its form is elongated, and somewhat prismatic, the dorsal surface being rounded, and the inferior surface flat. Its ordinary length is four or five inches. It is thicker, and especially higher, at its fore part, where its breadth is from four to five lines, and its height six or seven. Both dimensions diminish towards the posterior part, and especially the height, which is there reduced to less than a line, while the breadth is still two lines. The anterior extremity is obtuse. The cups are placed at the inferior surface. Fifty-two pairs were counted. M. Cuvier then described the stomach, intestines, and alimentary orifice, which latter appears to be single. He then passed to the very remarkable apparatus which he supposes to belong to its generative faculty. This organ, the uses of which still remain to be determined in a precise manner, will afford a curious subject of investigation to the naturalists who may have an opportunity of observing the animal in its living state.

" Such," said M. Cuvier in concluding, " are the observations which I have made on this truly extraordinary animal. I doubt not that the attention of the naturalists who inhabit the shores of the Mediterranean having been once excited by this first notice respecting so remarkable a creature, will soon complete its history, whether, by supplying what is wanting in my memoir, or by rectifying the errors into which I may have fallen."

On the Ancient Forests of Scotland. By P. F. Tytler, Esq. F.R.S. F.A.S. &c.

We must be careful not to permit the ideas which are derived from the condition of Scotland in the present day, to influence our conclusions as to its appearance in the rude and early ages of its history. No two pictures could be more dissimilar than Scotland in the thirteenth and fourteenth, and Scotland in the nineteenth century. The mountains, indeed, and the rivers, are stern and indomitable features of nature, upon which the hand of man can introduce but feeble alterations; yet, with this exception, every thing was different. The face of the country was covered by immense forests chiefly of oak, in the midst of which, upon the precipitous banks of rivers, or on rocks which formed a natural fortification, and were deemed impregnable by the military art of that period, were placed the castles of the feudal barons. One principal source of the wealth of the proprietors of these extensive forests consisted in the noble timber which they contained, and the deer and other animals of the chase with which they abounded. When Edward I. subdued and overran the country, we find him in the constant practice of repaying the services of those who submitted to his authority, by presents of so many stags and oaks from the forests which he found in possession of the crown. Thus, on the 18th of August, 1291, the king directed the keeper of the Forest of Selkirk to deliver thirty stags to the Archbishop of St Andrews, twenty stags and sixty oaks to the Bishop of Glasgow, ten to the High Steward, and six to Brother Brian, Preceptor of the Order of Knights Templars in Scotland.*

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* These curious details, illustrative of the former extent of the Forests of Scotland, are extracted from volume ii. of a History of Scotland, by Patrick Fraser Tytler, Esq., F.R.S. and F.A.S.; a work distinguished by those qualities which ought to characterize legitimate and patriotic history. No one, indeed, who takes an interest in the glorious deeds of arms, and striking displays of mental energy exhibited by our ancestors, and who delight in tracing the gradual advancement of Scotland from its comparatively rude and simple state, to its more refined although less energetic condition, but will peruse the volumes of this work with feelings of unmixed pleasure, and express the hope that the author may finish the plan he has sketched out.

To mark the names, or define the exact limits of these huge woods, is now impossible; yet, from the public records, (chiefly the Rotuli Scotiæ, lately printed at the expense of Government), and the incidental notices of authentic historians, a few scattered facts may be collected.

In the north, we find the Forest of Spey, extending along the banks of that majestic river; the forests of Alnete, and of Tarnaway, of Awne, Kilblene, Langmorgan, and of Elgin, Forres, Lochindorb, and Inverness. The extensive county of Aberdeen appears to have been covered with wood. We meet there with the forests of Kintore, of Cardenache, Drum or Drome, Stocket, Killanal, Sanquhar, Tulloch, Gasgow, Darrus, Collyn, and what is called the New Forest of Innerpeffer. In Banff was the forest of Boyne; in Kincardine and Forfar the forests of Alyth, Drymie, and Plater; in Fife, those of Cardenie and Uweth; in Ayrshire, the forest of Senecastre; in the Lowlands, those of Drumselch near Edinburgh, of Jedburgh, and Selkirk, Cottenshope, Makdesley, Ettrick, and Peebles; of Dolar, Traquhair, and Melrose.

The counties of Stirling and Clackmannan contained extensive royal forests, in which, by a grant from David I. the monks of Holyrood had the right of cutting wood for building and other purposes, and of pasture for their swine. In the reign of the same king, a forest covered the district between the Leader and the Gala; and in Perthshire, occupied the lands between Scone and Cargil. Immense tracts which, in the present day, are stretched out into an interminable extent of naked and desolate moor, or occupied by endless miles of barren peat hags, were, in those early ages, covered by noble forests of oak, ash, beech, and other hard timber.* Huge knotted trunks of black oak, the remains of these primitive woods, have been and are still discovered, buried deep under the surface, in almost every moor in Scotland. Such, indeed, was, at an early period, the extent and impervious nature of these woods, that the English, in their invasions, endeavoured to clear the country by fire and by the hatchet; and Knighton relates, that in an expedition of the Duke of Lancaster into this country, in the reign of Richard the Second, this prince, having recourse to these methods, employed in the work of destruction so vast a multitude, that the stroke of eighty thousand hatchets might be heard resounding through the forests, whilst the fire was blazing and consuming them at the same moment. So utterly erroneous is the opinion of one of those conjectural historians, who pronounces that there is little reason to think that in any age, of which an accurate remembrance is preserved, this kingdom was ever more woody than it is now.

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* Ash and Beech have indeed a place in the Flora Scotica of Lightfoot and of Hooker, and they have long ornamented our "woods and plantations." But there is great reason to doubt their being truly indigenous to this country, or having formed any part of the ancient forests. No traces of them occur in our peat-mosses; yet ash-keys and beech-mast would in all probability have proved as indestructible as hazel-nuts or fir-cones, which are abundant in many peat-mosses. Besides the oak, which seems greatly to have prevailed, the ancient forests probably consisted chiefly of Fir, meaning the Pinus sylvestris or Scots-fir; Birk or birch; Hazel; Wych Elm, or broad-leaved, not the smooth wych-elm of England; Roan-tree or mountain-ash; Yew; Aller or alder; and Saugh, as the sallow is here called.—EDIT.

In the fourteenth century, however, many districts in the midst of these forests had been cleared of the wood, and brought under cultivation. Thus, in the Forest of Plater, in the county of Forfar, David the Second, in 1366, made a grant of four oxgangs of arable land for a reddendo of a pair of white gloves, or two silver pennies, to Murdoch del Rhynd. In the same forest, the monks of Restennet, at the death of Alexander the Third, enjoyed the tenth of the hay made in its meadows; and in 1362, the king permitted John Hay of Tullyboll, to bring into cultivation, and appropriate the whole district lying between the river Spey and the burn of Tynot, in the Forest of Awne. From these facts it may be inferred, that the same process of clearing away the wood, and reducing large districts of the forests into fields and meadow lands, had been generally pursued throughout the country. It was a work, in some measure, both of peril and necessity; for savage animals abounded as much in Scotland as in the other uncleared and wooded regions of northern Europe; and the bear, the wolf, the wild boar, and the bison, to the husbandmen and cultivators of those rude ages, must have been enemies of a very destructive and formidable nature.*

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* The Brown Bear (Ursus arctos) appears to have been extirpated in the 12th or 13th centuries. The Wolf existed till towards the close of the 17th century, there being on record an authentic account of the killing of one in

Salt Wells and Springs of Inflammable Gas in China.

The following details which appear deserving of the attention of naturalists, have been printed in No. 16 of the *Annales de l'Association de la Propagation de la Foi*, a periodical work, containing the letters of the Bishops and Missionaries of the missions to the two worlds, and which forms a continuation to the *Lettres edifiantes.* M. Drufesse, bishop of Tabraca, who died in the exercise of his apostolic functions, had said a few words respecting the salt springs; but the subject is treated much more at length in the number mentioned above, by M. Imbert. The geographical position of the country in which these wells occur, is determined in an accurate manner by M. Klaproth, whose authority gives additional credibility to the account of the missionaries. We shall content ourselves with giving the facts, without following the opinions or adopting the terms of the author.

The greatest number of salt wells and springs of inflammable gas, of which we here speak, occur, according to M. Klaproth, in the districts of Young-Hian and Wei-yuan-Hian, in the department of Kia-Ting-Fou, in the Chinese province of Szu-Tchhouan on the borders of Thibet. There are several other wells of the same nature in the other districts of this department, and in the other neighbouring districts situated to the east of the great chain of mountains, covered with perpetual snow, which traverses the eastern part of Szu-Tchhouan from south to north.

According to the report of M. Imbert, there are in the vicinity of the town of Ou-Thouang-Khiao, several thousands of

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1680. The Boar, the origin of our common pig, occasionally occurred in a wild state till about the same period. According to Dr Fleming ("British Animals" *in loco*), the skulls and horns of the Ox tribe found in our peat-mosses and marl-pits, are chiefly those of an animal closely allied to the Bos Taurus (the stock from which our present black cattle have sprung), and not of the Bison; but the remains of the European bison (B. Urus) have repeatedly been found in England, and the probability certainly is, that it was also an inhabitant of Scotland. It may be added, that the Beaver was formerly a denizen of the wooded margins of our lochs, but has disappeared with the ancient forests.—*Edit.*

these salt wells in a space of ten leagues by five.* Every person who is tolerably rich, takes a few associates with him, and digs one or more wells. The expense of digging a well is from seven to eight thousand francs. These wells are commonly from fifteen to eighteen hundred French feet in depth, while they are only five or at the most six inches in diameter. They are almost always bored in the solid rock.

The process employed by the Chinese, in forming them, although very simple, is not described by M. Imbert so clearly as might be wished; it will be understood, however, on reading what follows. This people accomplish the most difficult undertakings with time and patience. There is sunk vertically into the bed of earth, which is commonly met with at the surface, a wooden pipe crowned with a hewn stone, perforated with a hole, which, like the pipe, has the same diameter as it is intended to give the well, that is, five or six inches. In this tube there is made to work a steel head of three or four hundred pounds weight. This steel head, the author says, is notched at the end, and is a little concave above and round beneath. A workman, by leaping upon the extremity of a balance or lever, the other extremity of which is attached to the steel head, lifts it to the height of two feet, and lets it fall again by its own weight. Some pails of water are thrown in from time to time, to assist the trituration of the substances. The spur or steel head is suspended by a good *corde de rotin*, of the diameter of the finger, but as strong as a cord of gut. A triangular piece of wood is attached to the cord, and each time that the lever raises the cord, a second workman seated near the tube, makes the triangle perform a half revolution, that the steel head may fall in a different direction. At noon, the second workman ascends upon the lever to take the place of his companion. At

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* According to M. Klaproth, the town of Ou-Thouang-Kiao, is four leagues to the east of the city of Tang-Kian, at the foot of the great mountain of Ou-Lhoung-Chan, which covers the whole country situated between the rivers Foung-Khi and Fou-kia-Ho. The following are the geographical positions of the places mentioned above:—

Kia-Tin-Fou, . . .	101° 28′ 45″ L. E.	—29° 27′ 26″ L. N.
Young-Hian, . . .	112 7	—29 33
Ou-Thoung-Khiao, .	112 11	—29 33
Wei-Yuan-Hian, . .	112 12	—29 38

night two other men takes their place. When three inches have been bored, the steel head is withdrawn, by means of a pulley, with all the substances with which its upper concavity is loaded. By this mode of boring, there are obtained wells which are perfectly vertical, and whose lower surface is highly polished. Beds, of sand, coal, &c., are frequently met with. The operation then becomes more difficult, and is sometimes entirely frustrated, for these substances no longer offering an equal resistance, it happens that the well loses it verticality, but these cases are of rare occurrence. At other times the iron ring which bears the steel head breaks. When this accident happens at a certain depth, the Chinese know no other means of remedying it than to employ a second steel head to break the first, an operation which may take several months. When the rock is good, an advance of nearly two feet is made in twenty-four hours; so that it takes about three years to dig a well.

The apparatus for drawing the water is equally simple with that which is employed for boring. A bamboo tube, twenty-four feet long, at the end of which is a valve, is let down into the well. When it has reached the bottom, a workman pulls at the cord which sustains it, giving it strong jerks; each jerk opens the valve, and fills the tube with water. It is then drawn out by means of a kind of vertical capstan, or large windle, fifteen or sixteen feet in diameter, which is put in motion by two, three, or four buffaloes or oxen, and upon which the cord is rolled up.

The water of these wells yields by evaporation a fifth, and sometimes a fourth of salt. This salt is very sharp, and contains much *nitre*.* For distillation there are employed large cast iron cisterns, five feet in diameter by only four inches in depth. The metal is at least an inch thick, and at most three. The mass of salt, which has the form of the cistern, weighs upwards of two hundred pounds, and is very hard. It is broken into three or four pieces, to be disposed of in commerce.

Now, what is very extraordinary is, that these saline wells are frequently at the same time wells of inflammable gas. If, according to M. Imbert, a torch be presented to the orifice of a well when the tube full of water is near coming up, it inflames, and produces a jet of fire from twenty to thirty feet high, which may set fire to the shed of the well. This sometimes happens through the imprudence or malice of a workman. There are some of these wells from which no salt is taken, but which furnish enough of inflammable gas to carry on the distillation of the salt water obtained from other wells in the neighbourhood. Thus, near Thsee-Lieou-Tsing, * there are four wells in a valley, which at first yielded water, but are dried up twelve years ago. The people then dug, in order to find water, to the depth of more than 3000 feet, but in vain. There was seen to issue a column of inflammable air, charged with blackish particles, which continued to make its escape with a noise that was heard to a great distance. Over the orifice of two of these wells there was built a cover of hewn stone, six feet high, to prevent the approach of fire. This misfortune happened not long ago. The fire communicated itself immediately to the interior, and detonation took place, which shook the ground like an earthquake. It was attempted to extinguish the fire by throwing upon the orifice, mud, stones, or water, in small quantity, means which commonly succeed when the column of inflammable air is not great; but this method proved unsuccessful, and the flame continued until there was led to a height which overlooked the well a quantity of water, sufficient to form a small lake there, which, on being suddenly opened, was poured into the well. The expense attending this operation amounted to 30,000 francs, which, in China, is a great sum.

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* We suspect there is here a mistake, nitre being a compound foreign to salt springs.

As we have said, these springs of inflammable air are employed for heating and lighting all the salt works in the neighbourhood. Bamboo pipes carry the gas from the spring to the place where it is intended to be consumed. These tubes are terminated by a tube of pipe-clay, to prevent their being burnt. A single well heats more than three hundred kettles. The fire thus obtained is exceedingly brisk, and the cauldrons are rendered useless in a few months. Other bamboos conduct the gas intended for lighting the streets and the great rooms or kitchens. Thus, Nature presents, in this place, a complete establishment of gas light. The whole of the gas cannot be employed. The

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* According to M. Klaproth, the town of Thsee-Lieou-Tsing. or of *the well which runs itself*, is about a league below the place.

excess is conducted beyond the limits of the salt-work, and there forms three chimneys or columns of flame. The surface of the court is exceedingly hot, and burns beneath the feet. Even in January the workmen are half naked, having only a small pair of drawers to cover them. In winter, the poor people, in order to warm themselves, dig the sand to the depth of a foot. With a little straw, they set fire to the hollow thus formed, and sitting round it, warm themselves as long as they are so inclined. They then fill up the hollow with sand, and the fire goes out.

The singular circumstance of saline water and inflammable gas occurring together in the districts of Young Hian and Wei-Yuan-Hian can only be accounted for by the alternation of salt beds and beds of coal. In fact, the latter are often met with in boring the salt wells. Some coal mines are worked in this country. They contain much gas, and lamps cannot be burnt in them.. The miners obtain an imperfect light from saw-dust and resin, which burn without flame, and are not easily extinguished. In boring the salt wells, a bituminous oil (naphtha, no doubt) is met with, which burns in water. Four or five hundred pounds of it are collected daily. It is used for lighting the hall in which the wells and salt-pans are.

The salt-wells and coal-mines employ an immense number of the inhabitants; and some rich individuals have so many as a hundred wells in their possession.

Bibl. Universelle.

Remarks on the Ancient Flora of the Earth.

BRONGNIART's description of the plants of a former world, and account of the distribution of their principal forms in the different strata of the earth, is undoubtedly one of the most important contributions which geology has lately received. By means of it, we are, for the first time, able distinctly to view all the information connected with this important object. We are thereby made acquainted with the simplest elements of the different floras, from the earliest to the present time. Indeed, the law of the progressive development of the classes of plants, and of a gradual perfection of their organization from the remotest periods till the latest geological epoch, is proved by this investigation in as striking and evident a manner as has been done among the incomparably more numerous tribes of the animal kingdom belonging to a former age.

In consequence of the nature of the subject, investigations of this kind necessarily consist of two parts essentially different from each other, and the comprehensive knowledge they require is seldom found united in the same individual. For it is required not only to reconstruct the whole of an organic body from the imperfect remains that are preserved, and hence to draw a conclusion as to the family or species in which it may be classed,—but it is equally necessary to determine the nature and the age of the rock formations in which these organic remains are found.

Further, the first part of the investigation referred to, which belongs entirely to the province of Natural History, is incomparably more difficult to be developed from the remains of vegetable bodies than from those of the animal kingdom; for the essential characteristics of the latter are more numerous, and much less liable to complete destruction. The zeal with which our cotemporaries have pursued this object, has greatly contributed to remove many of the difficulties; and, independently of the first attempts, particularly those of Schlotheim and Count Sternberg, no one has devoted himself to these pursuits with greater sagacity and success than Brongniart. The natural history of fossil plants, in almost all its parts, has been completely changed by this eminent naturalist, and in a wonderfully short time. Though we are anxious to make our sincere acknowledgments of the great value of the descriptive part of his Natural History of the Vegetable Kingdom, we are, notwithstanding, obliged to put forth some objections to the purely geological part of M. Brongniart's work, which occurred to us in the course of reading his introductory treatise.*

After the character of the Floras into which the vegetation of a former age may be divided, M. Brongniart distinguishes four different periods, and he determines them geognostically in a similar though much more accurate manner, than had formerly been attempted by Count Sternberg. (Fascic. iv. p. 32.) According to him, the first period comprehends the

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* In the Edinburgh New Philosophical Journal, vol. vi. there is a translation of Brongniart's Memoir "on the Vegetation of the Earth at different periods."

transition rocks and the *coal formation;* the second is confined to the formation of the *variegated sandstone*, the third contains all the strata of *keuper*, to the lowest members of the chalk formation, and the fourth comprehends all the formations found *above the chalk*. Though the details given by M. Brongniart seem so far to favour this distribution, we cannot help remarking, that it cannot be adopted in a purely geognostical sense, and that we, at first sight at least, can recognise only the first and last periods as independent formations. The author himself, indeed, makes the same remark, when he states that the second and third of these different periods do not very closely correspond with the divisions which the most of geologists receive as separate groups of formations. It appears to us, also, as if he had not sufficiently considered that the distinctions adopted by himself are founded only on the local relations of the rock formations, and cannot consequently possess a general character. We cannot, indeed, with propriety, consider the separation of the first and second periods by the formations of the *old red sandstone* and the *magnesian limestone* or *zechstein* as by any means generally prevalent; for it is at present universally acknowledged, that though, in a great part of Germany and England, such a separation may take place, either in both formations, or in one of them, nevertheless, in other extensive districts, no difference can be pointed out between old red sandstone, and the superimposed *new red sandstone.* We are hence obliged to consider both rock formations as nothing else than the under and upper strata of one and the same formation in which the formation of magnesian limestone or zechstein but occasionally makes its appearance as a subordinate bed, and that always of small extent. Our author cannot possibly be ignorant that this view is very strikingly exemplified in the rocks of France. In no part of that country has a bed of limestone been found, which could, with any probability, be compared with the magnesian limestone or zechstein. This is also known to be the case in the south of Germany, and, as far as our observation extends, among the Alps also, where, nevertheless, the conjunction of red sandstone with quartz porphyry is known to be nothing uncommon. In the northern parts of the British islands, in which strata so like *copper-slate* or *kupferschiefer* were lately discovered, the division of the old red sandstone and the variegated sandstone is but very imperfect.

This remark is of still greater consequence, when applied to the distinction of the second and third periods, according to our author's division. In these we observe the *variegated sandstone* separated from the keuper by the *shell-limestone* (*muschelkalk*) formation. It is known, however, that there are extensive districts in which no traces of this rock, the shell-limestone, which separates the two formations, are to be found, and in which the formation of variegated sandstone and the keuper formation are necessarily blended into a single mass. This is the case, for instance, in the extensive and important formation of *red marl* in England, which unquestionably belongs to both formations. It consequently appears to be very difficult, amidst this simple rock formation, to propose a separation of such importance as the appearance of two perfectly new creations of organic beings seems to require.

Independent of the striking want of agreement known to exist in the division of rock formations, according as they are distinguished, either by the principles of superposition, or according to the distribution of organic bodies, we would nevertheless have attributed no importance to these objections against the method of M. Brongniart. We are further obliged, however, to start various doubts as to the accuracy of some other views presented by M. Brongniart, and closely connected with the principles referred to.

After the description which M. Brongniart gives us of those relations in which the Floras of the different formations stand to one another, he proceeds to say, that he is inclined to think that the successive creations of plants are distinguished by a sudden change in the essential characteristics of vegetation. This opinion of our author appears to have been formed, as if the intervals between the ceasing of an old flora, and the commencement of a new one, had been filled up by an overflowing of the ocean. He has therefore attempted to prove, either that no organic remains occurred, or if any, only those of marine plants are found in the strata which separate the members of the four divisions already alluded to. This opinion, however, we are not inclined to admit as equally conclusive.

He sets out by affirming, that no remains of plants have been observed in the old red sandstone (*rothliegende.*) We would, however, request our author to compare only one of the numerous memoirs which treat of this rock formation, to convince himself that this opinion of his is inaccurate. The works of Charpentier, Freisleben, Schlotheim, Hoff, &c., abound in information regarding the local situation of the plants of a former world, met with in the undoubted formation of *old red sandstone*, or *rothliegende*. In the classical work of Alex. v. Humboldt, (*Essai sur le Gisem.* p. 214), we find the remark, that the whole formation of the red sandstone (*gres rouge*), is generally characterised by the absence of fossil shells, but that in both hemispheres it abounds in trunks of fossil trees and other debris of the monocotyledones. (V. Rel. Hist. t. x. p. 278.) I myself have had frequent opportunities of admiring the great number of petrified trunks of trees found in the quarries at Kyffhaüser in Thuringia, in the midst of old red sandstone, some of them three feet thick, and from twenty to thirty feet long. They are exactly the same with those which are not uncommon in the whole extent of the old red sandstone throughout the district of Mansfield, and also in the Thuringerwald; and occasional examples of them, from their upright position, seem to prove that they grew immediately in the place where they are at present buried. From the previously mentioned works (particularly from those of Freisleben, Kupfersch, vol. iv. p. 172,) it is sufficiently known that a great part of the coal formations in the north of Germany, particularly those of Manebach at Ilmenau, of Wetten, of Opperode, Ilfeld, &c., which have become so famous as depositories of vegetable remains, are found as subordinate beds in the midst of old red sandstone, or *rothliegende.* The truth of this assertion I have had an opportunity of proving in various places. From the uppermost strata of old red sandstone, *rothliegende* itself, which some refer to the formation of *zechstein*, (S. Freisl. l. c. iii, p. 238,) we have recently received intelligence of the abundant appearance of a plant which is evidently a freshwater production. (Leonh. Taschenbuch. xxii. I. p. 253.)

M. Brongniart further maintains, that, hitherto, nothing but marine plants has been found in the formation of magnesian limestone or *zechstein;* and this opinion seems probable, when we reflect that the very numerous animal remains of this formation have, for the most part, been inhabitants of the ocean. From the accurate discrimination of M. Brongniart, we have lately learned to recognise from five to six kinds of *Fucoides*, which are found in the copperslate or *kupferschiefer*, (a member of the magnesian limestone) of Mansfeld, and in the forest of Thuringia. It is nevertheless highly probable, that at the time when this remarkable intermediate stratum was formed, there were parts of the dry land rising above the level of the ocean. We at least find sufficient proofs of land plants occurring along with those just mentioned, in *zechstein* and *kupferschiefer*. For if, upon closer investigation, those plants called *Lycopodium* by Schlotheim (Leonh. Taschenbuch, vii. p. 55,) and the Lycopodiol. funiculatus of *Ilmenau* (Petrefactenk, p. 415; Lycop. taxifolius, Sternb. Fasc. iv. p. 8), are proved to be nothing else than sea-algæ; and if the remark made by Count Sternberg (Fasc. iv. pp. 40, 44), that *Bruckmannia tuberculata*, *Pecoptoris obtusa*, and *Alethopteris vulgatior*, are found in *kupferschiefer*, may have been caused by imperfect information regarding their local situation; yet Freisleben (Kupfersch. Geb. iii. p. 182), very distinctly describes the impression of an *articulated calamite*, or similar plant, in the *kupferschiefer* of the county of Mansfeld. Single pieces of coal, in which the fibrous texture of wood is preserved, are neither in Mansfeld nor in the forests of Thuringia of rare occurrence. But the woods, having the *Dicotyledonous* structure, and so abundant at Frankenberg in Hesse, are above all things convincing. More than twenty years ago they were described and delineated by Ullman (Mineralogberg, and Hüttänmanische Beobachtungen, 1803, p. 80, tab. i); and recently by Bonn (Leonh. Taschenbuch, 1828, p. 509), they were with great probability considered as a kind of cypress. Impressions of ferns are also frequently found along with these woods. The latest observations entitle us to reckon the formation of Frankenberg rich in mineral treasures to the *zechstein* or *kupferschiefer*. I may here be further permitted to state, that Mr Sedgwick found in the marl-slate of East Thickley in Durham, impressions of two or three species of ferns, some of which perfectly correspond with those of the copper-slate, *kupferschiefer* of Mansfeld, and appear in corresponding strata, which leaves no doubt of the identity of this formation with that of the *zechstein* formation in Germany. (Philos. Mag. et Ann. of Philos. vol. iii. p. 302.) If, after the evidence here adduced, we may be permitted to assume that there is no very decided distinction between the first and second of M. Brongniart's periods of the vegetation of a former age, the same may, very probably, be the case with the following periods. According to him, the second and third periods are separated by the formation of *shell limestone* or *muschelkalk*. The circumstance, however, that, in this limestone, in a great part of Germany, there is a particular coal formation, accompanied by remains of land plants (Lettenkohle of Voigt), cannot be here brought forward, for late observations have proved, that this coal formation belongs to the *keuper*, not to the shell limestone. Hence, on reference to the division of the second and third periods, we can only infer, that the formation of the shell limestone, or muschelkalk, does not belong to the class of rocks universally distributed, and that it may often happen that we find the strata of *keuper* that contain plants, as well as those of the variegated sandstone, to be nothing else than upper and under beds of one and the same formation, in conformable stratification. But, lastly, we must dissent from M. Brongniart's opinion in regard to what he considers the upper boundary of the third period, that only marine plants are found in the chalk formation. (Ann. des. Sc. n. 4. p. 217. Hist. des. Veget. Foss. libr. ii. p. 85. note, &c.)

Indeed it is known, that generally in the formation of true chalk, and in that of chalk-marl and greensand (*quader-sandstein*) belonging to it, vegetable remains are seldom found, in comparison with the immense accumulation of petrified animal remains which characterise it. According to the most accurate statements, as many of these plants appear to belong to the land as to the sea. If we next, in reference to the chalk of England, compare the multitude of observations contained in the transactions of the Geological Society of London, we find, first, observed in the chalk of Cambridge near Cherry Hinton, by W. Hailstone (G. Tr. iii. 250), coniferous fruits and branches with leaves, which the author is inclined to reckon in the family of the *Coniferæ*. They had been previously described by Parkinson, in his work on Organic Remains. W. Phillips also mentions, in the marl belonging to the chalk formation of Folkestone, (G. Tr. vol. i. pp. 49, 50), wood-coal, still possessing the fibrous texture of wood as an appearance by no means uncommon; and De la Beche found, in the well-defined greensand near Lyme Regis, on the coast of Dorsetshire, impressions of ferns. Gideon Mantell also, has already mentioned, as occurring in the chalk of Sussex, at Hamsey, at Lewes, and at Brighton, the stems with remains of leaves and distinct cones, which he compares with the fruit of the *Pinus Larix*. (Geology of Sussex, p. 108, tab. ix.) Count Sternberg has more recently referred these parts to an undetermined species of the genus *Conites*, and in every instance they seem to have been originally land plants.

We find these appearances more abundant in the strata belonging to the chalk formation of Germany. The greensand (*quader-sandstein*) and the *plänerkalk* of Saxony and Bohemia, the complete identity of which with the strata of greensand and *crai tufeau*, we may consider proven, afford numerous examples of them. That we may not be detained by unsatisfactory references, we will adduce the observations made by Count Sternberg. He describes and figures, as occurring in the *plänerkalk* of the lordship of Schmetschna in Bohemia, a species of the *Gatting Thuites*, (Th. alienus, *Synopsis*, p. xxxviii. Fasc. iv. p. 40. tab. lxv. f. 1.) of the family *Coniferæ;* and also leaves of trees of the class of *Dicotyledones*, which are here represented as a thing by no means uncommon in the greensand (*quader-sandstein*) near Tetcschen, so well known to geologists, (Tab. xxv. f. 1. a. b.) Exactly the same relation occurs in the contemporary strata distributed in the immediate neighbourhood of the Hartz. The leaves of *Dicotyledones*, so abundantly found in the greensand at Heidelberg near Blankenburg, are generally known. They are found along with trunks and branches, and cannot possibly, from the perfect preservation of their parts, derive their origin from older formations. In an exactly similar way we found leaves and fragments of large trees in the clay-beds of the same greensand (*quader-sandstein*) at Quedlinburg. They are there immediately connected with the strata of a chalky marl abundantly filled with green coloured grains, and abounding in distinctly defined remains of testaceous animals, identically the same with those found in the chalk of France and England. Further, we found impressions of exactly similar leaves of dicotyledonous plants in the chalk-marl near Wernigerode. In the same hand specimen we here observed leaves connected with a well-preserved specimen of *Belemnites mucronatus*; and I have since had an opportunity of witnessing the great similarity between these with the impressions of leaves found by Professor Nilson in the greensand of Schonen. In the chalk of Westphalia, which is almost uninterruptedly conjoined with that of the Netherlands and the north of France, and which are noted for characteristic fossil remains of animals, there are frequently found remains of plants undoubtedly belonging to the land. In the quarries near Soest, Werl, and Unna, we often found in the strata of grass-green sandy marl, so abundant in these places, pieces of a coaly substance, distinctly exhibiting the fibrous texture of wood. Equally numerous in those places are the remains of a plant, which, from the most perfect specimens we could find, undoubtedly belongs to the family of *Lycopodiaceæ*. It shews some slight analogy with the (Lycopodiol. dichotomus, Sternb.) particularly with the specimen delineated in tab. ii., and probably belongs to a species not hitherto described.

It would be easy to multiply the number of facts here given, by comparing a greater number of geological writings. We believe, however, that we may, with sufficient certainty, conclude, that the boundaries of the periods of vegetation fixed by M. Brongniart are really by no means distinguished by such precise and complete interruptions as he imagines.

Although there are probably none of the generally distributed strata formed by deposition, in which remains of a contemporary continuous land vegetation are not to be found, it still appears to be a very important question, as regards the crust of the earth, what relations the continued appearance of a single species of plants bears to the different periods of the vegetation of a former age. If, in this enquiry, we follow the numerous analogies presented by the relations of the animal creation of a former age, we shall be quite inclined to think, that the Flora of the different periods of vegetation must be distinguished from one another by perfectly distinct characters of the forms of the plants. In the commencement of the formation of every new kind of rock, we observe, that the animal remains that were characteristic of former formations almost entirely disappear. Entirely new forms often distinguished but specifically, and as often different in genus and family, appears suddenly, in the place of the old forms. The more that the researches of naturalists have enabled us to discriminate closely the organic remains of a former world, the more do the early statements so often brought forward vanish; as if there were certain genera and species of animals, which had escaped uninjured all the revolutions of the earth's surface. It appears in reality to have been these important analogies that directed M. Brongniart in the establishment of his principles, for we find him expressing it as his opinion, that no common character exists among the Floras of the different periods. M. Brongniart at least, expressly maintains, that the same species of plant does not occur in any two contiguous periods, that among them every thing is different, and that we cannot help believing, that an entirely new creation of members of the vegetable kingdom produced under perfectly new circumstances, may have displaced the older creation.

We would certainly have every reason to feel quite satisfied with these results of our author's researches, but for the circumstance that the knowledge of the plants of a former world developes some facts, that, according to our judgment, do not agree with his views. Before we, however, bring forward these facts individually, we cannot help remarking, that our objections by no means apply to the general character of the Floras, whose different periods of vegetation, the method M. Brongniart has with so much research determined. The method first pointed out by Alexander von Humboldt in his works on the geographical distribution of the plants on the present surface of the earth, of characterising the floras of different regions by the *quotients* which determine the natural families by their union, has been attempted in this department by M. Brongniart with equally successful results. Hence he justly remarks, that although later observations should add newly discovered forms to the individuals adduced by him, yet, in the essential characters, his floras would remain with but an unimportant alteration.

When we, however, proceed to compare the successive division of plants in the different epochs of the earth's formation, with their geographical distribution on the present surface of the globe, it will not seem wonderful that the species observed in the one district are partly found also in the other; for it is generally known that, in the present state of vegetation on the earth's surface, there are single species which are preserved unchanged through every zone and climate. In the same manner it is well known that the transitions of floras from one region to another take place only by the gradual substitution of single species by others more or less closely related to them, as well as by the gradual decrease and disappearance of single families; while others increase in the universality of their distribution as well as in the number of their species.

The formations of old as well as modern epochs, in opposition to the statements of M. Brongniart, afford us many instances of the equal appearance of kindred species belonging to a former age in different formations. We have already remarked, that many of those coal formations, distinguished for their abundant vegetation, can be shewn to be subordinate beds of old red sandstone, while others, indeed, by far the greater number of them, such as the celebrated basins of England, Flanders, Westphalia, and the Lower Rhine, belong entirely to the transition rocks; and yet, among the vegetable remains of both formations, no permanent distinction has hitherto been discovered. There are often enough the same *Lepidodendra*, *Sigillariæ*, and *Calamites*, the same kinds of *Neuropteris*, *Pecopteris*, of *Asterophylla*, *Annularia*, *Stigmaria*, &c., which were known to belong to the coal-pits of Manebach, Wetten, and Essen, and also of Luttich, Namur, Valenciennes, Newcastle, Bath, &c.* It farther seems as if the character of the vegetation of these old periods had preserved itself unaltered even to the uppermost strata of the old red sandstone or rothliegende. At least we sometimes observe among the trunks of trees dug up at Kyffhäuser, and in the Forest of Thuringia, some whose inner texture so very closely agrees with what are called star-stones, found in beds of coal (*Palmacites macroporus* and *microporus*) that we cannot help believing them to have belonged to a species perfectly identical. Moreover, impressions of *Lepidodendron* have frequently been found in the old red sandstone or rothliegende of Rothenburg, (L. aculeatum, Sternberg.) Fragments of *calamite* have also been found in the same formation; and we can hardly doubt, according to circumstances, that the softer parts of plants in pit-coal would be found here also, had not the predominating coarse grains, and the tumultuous formation of the old red sandstone formation, prevented their preservation. In exactly the same way, no traces of plants, except the imperfectly preserved remains of the stems of *Lepidodendron*, *Calamites*, &c., are ever found in the coarse granular strata of coal sandstone; neither are the leaves and the finer traces of *Filices*, *Lycopodiaceæ*, and others of the same kind, ever found in such coarse conglomerated strata.

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* The general view of the localities of the species of fossil plants described by Sternberg in his "Tentamen Floræ Primordialis," affords an interesting contribution to the above important fact. One hundred and fifty species (of which 138 are vascular cryptogamia) are accurately described and enumerated as belonging to the old coal formation in general. Of these seventy-five species belong exclusively to the oldest formation, forty as exclusively to the coal formation of the old red sandstone or rothliegende, and thirty-five species, about the fourth part of the whole, occur equally in both.

It further seems to us, as if the characteristic forms of remote periods were continued by the perfect accordance of the species, even to much newer strata. We, for instance, owe to Schlotheim the knowledge of a remarkable *Syringodendron*, (his Palmacites canaliculatus, Petrifactenk, 396, tab. xvi. f. 2,) found in the strata of the sandstone at Gotha, decidedly belonging to the *keuper formation*. Count Sternberg has since recognised it as identical with his *Syringodendron sulcatum*, found also in the coal of Eschweiler, Essen and Waldenburg. But this observation appears to us particularly important on this account, because we have lately been assured by the remarkable researches of M. Brongniart, that one of the same species of plants, belonging to a former age, is known to exist both in the sandstone of the *keuper formation*, and in the strata belonging to the formation of the *Lias* and *Oolite* of the *great Jura formation*. But these are rocks, which, in regard to their kind of formation, and the character of their animal remains, are as perfectly different from one another, as, on the other hand, the characters of the transition rocks are distinguished from that of the old red sandstone.

It is unsatisfactory, in investigations of this description, to appeal to examples which do not rest on sufficiently accurate determinations. Of this description, according to the testimony of Brongniart, are the occurrence of *Calamites arenaceus* in the *keuper* and in the *variegated sandstone*, and the *Calamites remotus* or *distans* in the *variegated sandstone* and *coal formation*. Such examples, however, prove the very great similarity of the forms which appear destined mutually to occupy one another's place in the different periods of the vegetation of a former time. M. Brongniart has himself shewn us a remarkable example of one and the same species in the strata of two perfectly different formations. It is, his *Fucoides Brardii*, (Hist. de Veget. Fossiles, livr. i. p. 77, tab. ii. f. 8–19. Ann. d. Sc. n. xv. p. 452,) found both in the *Lignites* under the chalk at Pialpinson, and also in the copper-slate (*kupferschiefer*) of Frankenberg. But how shall we account for so striking a contradiction in the principles and facts that should form their foundation?

In the comparisons hitherto adduced, we have intentionally avoided returning to the remarkable discoveries of H.H. Elie de Beaumont, and Ad. Brongniart, in the phenomena of vegetable remains in the *anthracite* sandstone of the Southern Alps. M. Brongniart, as is known, has here recognised in the strata belonging to the most decided *lias* formation, at least 15 species of well preserved ferns, which were hitherto found together, only in the old coal formation. In the same locality, he has detected the appearance of *Lepidodendrons*, *Sigillaria*, *Stigmaria* and *Calamites*, which were hitherto supposed to belong exclusively to the coal formation. But the ingenious hypothesis which M. Brongniart has herewith brought forward, (Ann. Sc. d. n. t. xiv. p. 127.) and more recently expressly maintained, (l. c. tom. xv. p. 375 note,) to explain these remarkable anomalies, is as little satisfactory to us, as it is at variance with the general views entertained by its author.

If, however, the hypothesis of M. Brongniart, which we oppose, is really established by further investigations, there still remains the undisputed fact, that, during the third period of vegetation, there may, in a part of the earth's surface, have been plants which correspond in all their known characters with those of the first period. But what, at the first look, may almost seem still more remarkable, is the circumstance, that these plants, in regard to the part which they, arranged in families, take in the general *Flora* of the globe, shew a similar deviation from the principal characters of the vegetation of these periods of formation. After the great development of the vascular *Cryptogamia*, we here observe the same remarkable predominance of that class which is peculiar to the Flora of the old coal formation. These remarkable anomalies by no means appear to us of much consequence. If we enquire into the general causes, which we may ascribe to the universally recurring peculiar character of the vegetation of the oldest periods of organic creation, we will find, in the acute observations of our author, a key to the solution of this apparent contradiction. For M. Brongniart, in his treatise, so often referred to (p. 244), has proved as cautiously as convincingly that the character of the Flora of his first period correspond perfectly with characters of the Flora of the present islands, and this agreement is the more striking, the more the islands are scattered in the main ocean, and the farther they are from great continents. What prevents us from concluding, that in those periods also of middle secondary formation, the same operations may have been produced by causes precisely similar? For if the present magnitude of the continental masses rising above the water, is not able to completely obliterate the important difference between a continental and an insular Flora, how much more may we not, from good grounds, expect the same difference in those periods in which the influence of great continents was in all probability not so great as at present. Yet, M. Brongniart, for this reason, gives to the character of the vegetation of this second and third period the name of a *Coast Flora.*

Before we conclude our remarks on a subject of such universal interest, we cannot help casting a look at the division of plants into families, which, according to the investigations of M. Brongniart, constitute the vegetation of his particular periods. Independent of the classes of *Agamous* and *Cellular Cryptogamia*, which here seem to us inconclusive, M. Brongniart next, in the first period, recognised only the presence of members of the class of *Vascular Cryptogamia* and of *Monocotyledonia*. He has thereby, however, as appears, allowed it to escape his observation, that two species of his genus *Conites*, (C. *cernuus* and *armatus*, xxxix. t. 29. f. 1, 2. and t. 46, f. 1,) had been before described and delineated by Count Sternberg, as belonging to the coal formation of Bohemia, whose *cones* appeared so distinct, that we can scarcely doubt that they may be justly ranked in the family of the *Coniferæ* or *Cycadea*. Three of the more perfectly organised classes of Brongniart have shown themselves already in the first period, though the last, as regards the amount of the whole, forms but a very insignificant fraction. In the number, however, of the classes that M. Brongniart ascribes to his third period, we consider ourselves entitled, from the foregoing observations, to notice an exception. We here find the appearance of *Dicotyledones* expressly denied, and yet the appearance of their undoubted remains both in the greensand or quader-sandstein, and in the Jura formation, is not at all uncommon. It will not be first necessary to call to mind the impressions of leaves in the period of the formation of chalk to which we have already referred on another occasion. Their well known structure, the distribution of their veins, leaves us not a moment to doubt with what to class them. It was more striking to us, however, to observe that M. Brongniart did not hereby think of his own early and numerous observations and remarks. For we find the leaves of many completely undoubted kinds of *Dicotyledona* in the sandstone formation of *Hoer* on Schonen, mentioned by himself; and the author himself attaches great value to these, as affording evidence of the age of the strata. The same appearances are also known to belong to the Jura formation. In the strata of this age, in France and England, we find the presence of *dicotyledonous* plants frequently mentioned. Desnoyers and Brongniart themselves knew the same in the Jura oolite of Mamers. Further, the same appearance probably occurs in the strata at Stonesfield near Oxford, so rich in fossils. Mr Webster has also described the abundant appearance of very considerable *Dicotyledonous* trees in the layers of Portland and Purbeck stone, (Geol. Trans. ii. p. 41,) standing upright, and having their concentric formation perfectly preserved. Among the remains of a former age found by G. Mantell, in the strata of the iron-sand of Tilgate Forest, there are also unquestionable remains of plants of this class. Count Sternberg has likewise already described the fruit of a species of juglans or, walnut found in the salt-works of Wielitzka, the beds of which, we may refer, according to the accurate researches of Professor Pusch, to the formation of Lias contemporary with the sandstone and limestone which, to such an immense extent, compose the mass of the Carpathians. For understanding the progressive development of organic bodies, during the different periods of the earth's formation, it is certainly a very important object to fix the limits from which are first exhibited traces of the most perfect organization, of which the members of the vegetable and animal kingdoms are in general capable. The question as to the first appearance of *dicotyledonous* plants, is of equal signification as that in regard to the first appearance of remains of quadrupeds in the crust of the earth. In the present state of the organic creation, the proportions of both classes to the total sum of animals and vegetables, appear regulated according to analogous laws. We, however, do not know so extensively the creations of the present time and of a former age, as to be able satisfactorily to estimate their relative numerical value, and we, of course, still stand in need of one of the most important documents regarding the economy of nature in the different periods of her formation. It is, notwithstanding, always of much importance to be able to look into the facts already established, and to observe that the gradual development of organic bodies in the animal and vegetable kingdom has followed precisely the same progress. While the simplest organised kinds of both kingdoms first appear, we also find repeated throughout the same gradations, as regards the gradual appearance and increase of the more perfectly organised beings in the strata of the earth's crust. Of the four footed animals, it is known that those which first appeared, viz. the amphibia, are the lowest in the zoological scale. While the division of saurian animals attains a remarkable development in the Jura limestone, in which at least twenty species have been distinguished, the more perfectly organised mammalia on the other side of the chalk, that is below it, seem to possess only a single representative; but on this side of it, that is above it, there occurs a state perfectly comparable with the character of the Fauna of the present creation, if we abstract the difference of climate. Such, also, is the case in the extensive range of the vegetable kingdom.

M. Brongniart has himself explained the character of the vegetation of his fourth period, as perfectly similar to that now in existence. The *dicotyledonous* plants which appear here, belong, for the most part, to the most perfectly developed families. In the period of formation, below the chalk, M. Brongniart found among the more highly organized vegetables only varieties of the natural families of the *Cycadeæ* and *Coniferæ* prevailing,—a fact of very great importance, the knowledge of which we owe exclusively to the laborious researches of this distinguished observer. The influence which these exercise in the present creation only through a small number of genera upon the Flora of these periods, seems to have induced M. Brongniart to raise them to the rank of a distinct class; for he distinguished them both in the tabular survey before us, and in his History of Vegetable Fossils (livr. i. p. 20), under the denomination of *Phanerogamous Gymnospermes*, and gave them a position between the *Vascular Cryptogamia* and the *Monocotyledona*. However important the grounds may have been that enabled the author to act thus, we can neither give an assent to the principles hence deduced by him, nor consider the place assigned to his new class as the right one.

Regarding the name of *Phanerogamous Gymnospermes*, occasioned by the remarkable researches of R. Brown, it does not become us to decide on the accuracy of the fact here brought forward. We may, however, have recourse to the opinions of two botanists of the first rank, Decandolle and Richard, who consider it by no means proven that the female flowers belonging to these plants can be regarded as a simple *ovula*, without *pericarpium*. If further investigations, however, should shew us that the families of the *Cycadeæ* and *Coniferæ*, in the numerous deviations which moreover so much distinguish them, still preserve this remarkable exception to the prevailing organization, yet the influence which this discovery can have on the classification of fossil vegetables, must always be of small importance. For it depends on the nature of the preservation of these remains of a former age, whether we, in all our attempts to arrange them in naturally distinct groups, according to the peculiarity of their forms, which arise from the organs of vegetation, will assign a greater importance to these, than to the organs of propagation. Their essential differences are particularly observable only in those parts which can scarcely ever come under the eye of an observer of the plants of a former age; hence the characteristics derived from such parts must evidently be placed in the lowest order. If we now consider the single varieties of *Cycadeæ* and *Coniferæ* according to their external perceptible peculiarities—if we compare the formation of their stems, the nature of the insertion of their leaves, &c., we will be at no loss what place to assign them. A. Richard, and after him Decandolle, has admitted, that the *Cycadeæ* are most closely related to palms and arborescent *Monocotyledones*, while the *Coniferæ* are immediately connected with the more perfectly organized *dicotyledones*. Indeed, the stems of the one, when found without being accompanied by leaves and fruit, are subordinate to the division *Endogenites;* but the others are such perfect *Exogeniteæ*, that we cannot, without reluctance, surrender the general validity of this important distinction as the foundation of two great main divisions of all remains of plants not precisely determined. M. Brongniart himself, from similar grounds probably, has inserted in his Tabular Survey the genera *Endogenites* and *Exogenites*, though they here lose all signification, from his having established a fourth class.

Though, for the reasons assigned, we wished both families of this new class in M. Brongniart's Tabular Survey separated, and the one associated with the *Monocotyledonous Phanerogamia*, the other with the *Dicotyledonous Phanerogamia*, we have by no means overlooked their very close affinity, which first of all became remarkable from the memorable researches of Richard and his son. The peculiar embryo with two *cotyledons*, which had not before been observed of any known species of the *Palmeæ*, *Liliaceæ*, &c. brings the Cycadeæ so very near the *Dicotyle-*

dones, that we, from the simple observation of this character alone, would no longer hesitate to transfer them to this higher class. On the other hand, the *Coniferæ*, from the imperfect organization of their organs of fructification, descend from the great division of the Dicotyledones to the foregoing class; and yet, on the other hand, they are so intimately conjoined with the more highly organized classes, and, indeed, by the same properties, as caused us to place the *Cycadeæ* with the *Dicotyledones*. If, therefore, we consider M. Brongniart's *Gymnospermous Phanerogamia*, as an independent class of vegetables, we would immediately transpose them, according to a different system of denomination, to a place between his fifth and sixth classes. This is also the precise spot which the varieties belonging to them occupy, according to their appearance in the succession of strata that compose the crust of the earth. The first traces of them are lost in the oldest secondary sandstone formation, as the first traces of the more imperfectly organized quadrupedal amphibia appear in the oldest secondary limestone. Both of them gradually increase, and indeed predominate, in the *Flora* and *Fauna* of formations, which lie below the chalk; and both are at last displaced by the more perfectly organized forms of both families, belonging to the latest period of creation, which immediately preceded that now in existence.

If we now take a summary survey of the results of the foregoing considerations, it appears—

1*st*, That among the universally distributed rock formations, since the first appearance of organic beings, there is not one of them in which the remains of a contemporary land-vegetation are not to be observed.

2*d*, That the different periods of the vegetation of a former age are gradually, from the oldest to the newest, characterized by the continual entrance of new, and always more perfectly organized families of plants; but that there is not connected with that arrangement a complete disappearance of all the species of the preceding periods.

3*d*, That species of the most perfectly developed class the *Dicotyledonous*, already appear in the period of the secondary formations, and that the first traces of them can be shewn in the oldest strata of the secondary formation, while they uninterruptedly increase in the successive formations.*

On the relative Conductibility for Caloric of different Woods, in the direction of their fibres, and in the contrary direction.

By MM. Aug. de La Rive, and Alph. De Candolle.

The conductibility of the metals and some other substances has long been a subject of inquiry, on account of the important results which it has furnished with reference to the arts and sciences. There are other substances not less useful to be known in this respect, such as glass, porcelain, and other products of art, as well as woods of various kinds. A memoir by M. Desprez, inserted in the *Annales de Chimie*, has made known the relative conductibilities of some of these substances. We have thought that it would not be without interest to complete the knowledge which we possess on this subject, by comparing the conducting powers of certain species of wood. This comparison may, besides, lead to various considerations relative to vegetable physiology.

With this object, we procured well dried pieces of wood, of a square form, 4 inches 10 lines long, 18 lines broad, and 1 inch thick. To know the differences that might result from the direction of the woody layers, we had pieces sawn in the contrary direction to that in which wood is commonly wrought, that is to say, the fibres being transverse, in place of being in the direction corresponding to the length of the piece of wood. It is this direction contrary to the woody fibres that caloric follows, when it passes from the atmosphere into the interior of a tree, or *vice versa*. On one of the broad surfaces of these pieces of wood, beginning at the distance of three centimetres from one of the extremities, were bored, at equal distances of 9 lines, five holes, 7 millimetres in breadth, which reached only the middle of the thickness of the wood. Into each hole we poured a little mercury, into which a thermometer was immersed. One of the extremities of the piece of wood was sunk in a tin case, about 2¼ centimetres long, so as not to cover any of the holes. This apparatus was freely suspended in the air, and a spirit of wine lamp was placed under the extremity, armed with tin. The flame could only strike this part, on account of the chimney of the lamp and plates of glass which we placed vertically between it and the piece of wood, taking care to renew them as soon as the heat began to traverse them. In this manner, the source of heat was single, without, however, directly striking the wood in such a manner as to burn it. In order that the thermometer should have precisely the temperature of the interior of the wood, we threw a little lycopodium powder upon the orifices of the holes, which prevented all external radiation of the balls of the thermometers, and of the mercury which surrounded them.

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* The second part of this Memoir will appear in next number of the Journal.

At the end of from one to two hours, each thermometer had attained the maximum of temperature which its distance from the source of heat, and the conductibility of the wood, combined with the radiation, permitted it to assume. We only considered the experiment as ended, when the thermometers had attained their fixed point for ten minutes or a quarter of an hour. We have retrenched from all the thermometrical heights the temperature of the ambient air, which only varied from 6° to 10° centigr.

The kinds of wood which we tried are six in number, of which three were in the two directions of the fibres. Placed in the order of their conductibility, beginning with the best conductors, they are the following:—hornbeam, chesnut, oak, fir, poplar, all in the direction of the woody fibres; then chesnut, oak and fir, in the contrary direction; and, lastly, cork.

On comparing the two extremes, it is found that, in the hornbeam, a very hard and heavy wood, the first thermometer being at 83°, the second was at 45°, a little more than the half; while in the cork, the first being at 78°, the second was only at 14°, a little more than the fifth. The densest woods were in general the best conductors. Chesnut, however, is a somewhat better conductor than oak, although it is lighter. It is also seen from the table which follows, that there is little difference between the woods cut in the same direction, and that their slight homogeneousness render the results less regular than in the experiments which have been made on other substances; but there is a considerable difference according to the directions of the caloric, with reference to the woody layers. Woods are much worse conductors in the direction contrary to the fibres of which they are composed, than in that of their length. The difference which results from these directions of the caloric is so much the greater, the smaller the degree of conducting power which the wood possesses. Thus, referring to the second thermometer, and taking in each wood the differences resulting from the direction of the fibres, we find 16° in the chesnut, 22° in the oak, and 28° in the fir. In the oak, the conductibility in the direction of the fibres is to that in the perpendicular direction as 5 to 3.

The curve formed by the heights of the thermometers, which is a logarithmic curve in the bodies that are very good conductors, is not so regular in the substances which conduct ill. It decreases at first very quickly, and then becomes nearly parallel to the line of the abscisses. Thus, in the oak, the second thermometer being at a height six times less than the first, the last is very little different from the one next to it; it is at 1°, and the next to the last at 1° 56, while in the hornbeam the quotients are nearly equal. These numbers, which are directly given by experiment, do not express the conducting powers in an absolute manner, for they are the result of the combination of several elements, such as the dimensions of the body, their radiating power, &c., which elements would require to be calculated, were it wished to compare exactly the conductibility of woods with that of other substances.

The great difference which results from the direction, according to which the woody layers present themselves to the caloric, may in part explain how trees preserve so well in the interior of their trunk the temperature of the soil, from which they extract their nourishment. On the one hand, this temperature transmits itself by the ascent of the fluids, and by its propagation in the solid tissue of the wood, while the little conductibility in the transverse direction forms a great obstacle to its coming into equilibrium with the external temperature.

	Thermometrical Heights, from which the Temperature of the Air has been subtracted. Centigrade Degrees.					*Quotients* obtained by dividing the Height of the 1st Thermometer by that of the 2d, that of the 2d by that of the 3d, &c.				*Height* of the 2d Therm., the 1st being at 100°, calculated from the relations observed.
	1st Ther.	2d Ther.	3d Ther.	4th Ther.	5th Ther.	1st Quot.	2d Quot.	3d Quot.	4th Quot.	
Hornbeam in the longitudinal direction,	83·0	45,0	21·2	9·2	4·4	1·84	2·1	2·3	2·1	54·28
Chesnut do. . .	80·13	43·0	19.63	9·19	5·13	1·86	2·19	2·13	1·79	53·7
Oak do. . .	81·7	41·2	17·5	7·2	3·7	1·98	2·35	2·43	1·94	50·5
Fir do. . .	84·0	39.25	20·6	8·5	3·7	2·1	2·3	1·9	2·4	47·91
Poplar do. . .	79·8	34·2	14·2	6·2	2·8	2·33	2·4	2·3	2·22	42·91
Chesnut in the transverse direction,	99·5	37·43	13·19	6·0	3·25	2·66	2·84	2·20	1·80	37·59
Oak do. . .	79·3	22·75	7·5	3·6	2·4	3·5	3·0	2·1	1·5	28·57
Fir do. . .	70·9	13·8	4·5	2·5	1·9	5·1	3·0	1·4	1·3	19·6
Cork do. . .	78·5	13·75	3·44	1·56	1·0	5·7	3·9	2·2	1·56	17·5

Annales de Chimie and Physique, Jan. 1829.

Account of the Nuremberg Boy, Caspar Hauser, who was shut up in a Dungeon from the fourth to the sixteenth year of his age.

About twenty-five years ago public curiosity and the solicitude of the scientific world, were powerfully excited by the discovery of the wild man of Aveyron, who was surprised in the woods leaping from tree to tree, living, in a naked state, the life of a baboon rather than that of a man, emitting no other sounds than imitations of the cries of animals which he had heard, or those which made their escape from his breast without the emotions of pleasure or suffering. A phenomenon of nearly a similar nature has, for the last fifteen months, engaged the attention of the learned in Germany. But in this case there do not exist the entire liberty, and the wild and erratic life, which degraded the intellect of the unfortunate being just mentioned. There has, on the contrary, been a state of absolute constraint and captivity. Hitherto nothing had transpired in France respecting this singular phenomenon, and we should probably have still remained ignorant of it, had it not been for the attempt at assassination made a month ago upon this unfortunate creature, now restored to social life; and, as would appear, pursued by the same villain who, for twelve years, had kept him buried in a dungeon. A person of high rank, and distinguished by the superiority of his mind, has addressed to us the following letter, which reveals, in some measure, the entire history of this unfortunate being. Our correspondent has seen and conversed with this mysterious young man. We have thought it right to publish his letter in the same spirit which dictated it, that is to say, less as the recital of an extraordinary and touching adventure, than as a subject of moral and psychological study. At the moment when we were sending this letter to press, we received the *Nouvelle Revue Germanique*, which is printed at Strasburg, and in which the same facts are translated from the *Hesperus*, one of the best of the German journals. But we have in addition, the assurance of authenticity and the observations made on the same subject by a person who, by profound study, has been familiarized with all the great questions of philosophy.*

" TO THE EDITOR OF LE GLOBE.

" Sir, *Paris, November* 15. 1829.

" Within a few days the French journals speak, for the first time, of the history of a young man found at Nuremberg, whose name is Caspar Hauser. They speak of him in consequence of the assassination attempted upon his person in the course of last month, quoting the *Austrian Observer*, which has itself derived its information from German journals printed in countries nearer the place of the atrocity than Vienna. The story appears to them incredible, and with good reason, for what is true is not always probable. I have seen the young man in question, and am able to furnish authentic information respecting him. I am convinced you will judge it worthy of being made public.

" In the month of May 1828, there was observed at the entrance of one of the gates of the city of Nuremberg, a young man who kept himself in a motionless attitude. He spoke not but wept, and held in his hand a letter addressed to an officer of the regiment of Light Horse in garrison in the town. The letter announced that from the age of four to that of sixteen years, the bearer had remained shut up in a dungeon, that he had been baptized, that his name was Caspar Hauser, that he was destined to enter the regiment of Light Horse, and that it was for this reason that the officer was addressed.

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* The letter is probably the production of the celebrated Cousin.

" On being questioned he remained silent, and when further interrogated he wept. The word which he most frequently pronounced was *haam*, (the provincial pronunciation of *heim*, home,) to express the desire of returning to his dungeon.

" When it appeared evident from the state in which the young man was, that the statement contained in the letter was true, he was confided to the charge of an enlightened professor of the most respectable character, and, by a decree of the magistrates, was declared an adopted child of the city of Nuremberg.

" Previous to my return to France, I had determined to visit that city, the only large town in Germany which I had not seen. This was about the end of last September. I was furnished with a letter to one of the magistrates, who, from the nature of his functions, had the charge of superintending the education of Caspar Hauser. It was this person who brought him to me; and, by a privilege which I should not have ventured to claim, the last moments of a residence devoted to the examination of the curiosities of this great monument of the middle age, afforded me an opportunity of seeing a very rare, if not unique, subject for the study of human nature. We beheld a young man, below the middle stature, thick, and with broad shoulders. His physiognomy was mild and frank. Without being disagreeable, it was no way remarkable. His eyes announced weakness of sight, but his look, especially when a feeling of internal satisfaction or of gratitude made him raise it towards the skies, had a heavenly expression. He came up to us without embarrassment, and even with the confidence of candour. His carriage was modest. He was urged to speak, to give us an account of his emotions, of his observations upon himself, and of the happiness of his condition.

" We had no time to lose, for our horses were already harnessed. While I was reading an account composed by himself, in which he had begun to retrace his recollection, he related to my travelling companion whatever had not yet been recorded in it, or replied to his questions. I shall, therefore, first present the details of the narrative, and then mention what was repeated to me of a conversation of which I heard only a part.

"His manner of speaking and of pronouncing German was that of a foreigner, who has exercised himself for some years in it. The motion of the muscles of the face indicated an effort, and was nearly such as is observed in deaf and dumb persons who have learned to speak. The style of the written narrative resembled that of a scholar of ten or eleven years, and consisted of short and simple phrases, without errors in orthography or grammar. The following is a brief account of it:—

"His recollections disclose to him a dark dungeon, about five feet long, four broad, and very low; a loaf of bread, a pitcher of water, a *hole* for his wants, straw for a bed, a covering, two wooden horses, a dog of the same material, and some ribbons, with which he amused himself in decorating them. He had no recollection of hunger, but he well remembered being thirsty. When he was thirsty he slept, and on awakening the pitcher was found full. When he was awake, he dressed his horses with the ribbons, and when his thirst returned he slept. The man who took care of him always approached him from behind, so that he never saw his figure. He remained almost constantly seated. He recollects no feeling of uneasiness. He is ignorant how long this kind of life lasted; and when the man began to reveal himself and to speak to him, the sound of his voice became impressed upon his ear. His words are indelibly engraved upon his memory, and he has even retained his dialect. These words ran exclusively on fine horses, and latterly on his father, who had some, and would give them to him. One day, (I make use of this word although it is improper, for to him there were neither day, nor time, nor space,) the man placed upon his legs a stool with paper, and led his hand in order to make him trace some characters upon it. When the impulse given by the man's hand ceased, his hand also stopped. The man endeavoured to make him understand that he was to go on. The motion being without doubt inopportune, the man gave him a blow on the arm. This is the only feeling of pain which he remembers. But the stool greatly embarrassed him, for he had no idea of how he should put it aside, and was utterly unable to extricate himself from this prison within a prison. One day, at length, the man clothed him, (it would appear that he wore only a shirt, his feet being bare), and taking him out of the dungeon put shoes upon him. He carried him at first, and then tried to make him learn to walk, directing the young man's feet with his own. Sometimes carried and sometimes pushed forwards, he at length made a few steps. But, after accomplishing ten or twelve, he suffered horribly, and fell a crying. The man then laid him on his face on the ground, and he slept. He is ignorant how long these alternations were renewed; but the ideas which he has since acquired have enabled him to discover, in the sound of his conductor's voice, an expression of trouble and anguish. The light of day caused him still greater sufferings. He retains no idea of his conductor's physiognomy, nor does he even know if he observed it; but the sound of his voice, he tells us, he could distinguish among a thousand.

"Here ends the narrative, and we now come to the conversation. During the first days which he passed among men, he was in a state of continual suffering. He could bear no other food than bread. He was made to take chocolate: he felt it, he told us, to his fingers' ends. The light, the motion, the noise around him, (and curious persons were not wanting to produce the latter), and the variety of objects which forced themselves upon his observation, caused an indescribable pain, a physical distemper, but this distemper must have existed in the chaos of his ideas. It was music that afforded him the first agreeable sensation: it was through its influence that he experienced a dispersion of this chaos. From this period he was enabled to perceive a commencement of order in the impressions by which he was assailed. His memory has become prodigious: he quickly learned to name and classify objects, to distinguish faces, and to attach to each the proper name which he heard pronounced. He has an ear for music, and an aptitude for drawing. At first he was fond of amusing himself with wooden horses, of which a present had been made to him, when he was heard continually to repeat the word horses, beautiful horses *(ress, schone ress)*. He instantly gave up, when his master made him understand that this was not proper, and that it was not *beautiful*. His taste for horses has since been replaced by a taste for study. He has begun the study of the Latin language, and by a natural spirit of imitation, his master being a literary man, he is desirous of following the same career.

"So extraordinary a phenomenon could not fail to inspire, independently of general curiosity, an interest of a higher order, whether in observing minds or in feeling hearts, and the women especially have expressed their feelings towards him in little presents, and letters of the most tender kind. But the multitude of idle visits they made to him, and especially these expressions of tender feeling, were productive of danger to him, and it became necessary to withdraw him from so many causes of distraction, and to lead him into retirement. Accordingly, he now lives retired in the bosom of a respectable family. Pure morals, an observing mind, and a psychological order, preside over his education and instruction, in proof of which, he has made immense progress in the space of the last sixteen months.

"Here, then, by the inexplicable eccentricity of a destiny without example, we have presented, and perhaps solved a problem, which from the Egyptian king mentioned by Herodotus, down to the writers of novels, to the Emilius of Rousseau, and the statue of Condillac, has exercised the imagination of men, and the meditations of philosophers. It is evident that in the profound darkness, the absolute vacuity in which Casper Hauser was for twelve years immersed, all the impressions of the first four years of his life were effaced. Never was there a *tabula rasa* like that which his mind presented at the age of sixteen. You see what it has been capable of receiving. But the metaphor is false, for you see how it has re-acted.

"In proportion as the sphere of his ideas enlarged, he has made continual efforts to pierce the shades of his previous existence. They have been useless, at least as yet. "I incessantly try," said he to us, "to seize the image of the *man*; but I am then affected with dreadful headachs, and feel motions in my brain which frightens me." I have told you that his figure, his look, and his port, bore the expression of candour, carelessness and contentment. I asked him if he had, either in his dungeon, or after coming out of it, experienced feelings of anger. How could I, said he, when there has never been in me (and he pointed to his heart) what men call anger. And this being from whom, since the commencement of his moral existence, had emanated all the gentle and benevolent affections, has all these illusions dissipated by the violence of an assassin. Happy, perhaps, had it been for him had he fallen under it, or should he yet fall! And yet, if, after having been struck by the murderer, he drags himself mechanically and squats in the corner of a cellar, as if he would again enter his cave, he who, in the first moment of his social existence, had no other wish than that of being led back to it, see him now become a social man to such a degree, that his first cry is to supplicate that he be not again led to it!

"This assassin, I only know, as yourself and as the public know, through the medium of the newspapers. The young man, they say, thought he recognized in him the voice of his conductor. It is probable that the conductor is the assassin; but it is also possible that the young man may be deceived; for in that so well remembered voice were concentrated all his ideas of evil. Be this as it may, it is as a psychological phenomenon that I have presented his history, and not as an adventure, respecting which every one may form his own conjectures. All that I can say is, that the functionary who presented him to us, and who, by the duties of his office, was charged with directing the inquiries, has informed me that for a moment they imagined they had found traces of a discovery; but these traces had ended in nothing else than the rendering it probable that the place of his imprisonment is to be found in a district at the distance of about ten leagues from the city of Nuremberg."—*Le Globe, 21st November.*

Fresh Water Springs at the Bottom of the Sea.

THESE springs occur near the islands of Bahrain and Arad, which are situated on the south side of the Persian Gulf. Bahrain is low and more fertile than any island in that gulf. Many fine groves of date trees are scattered over it, and perhaps the purest fresh water is to be found at a large pool having a spring near it, within two or three miles of the town of Monama. When Captain Maughan left Bahrain in 1828, the island was in the possession of the Ootoobies, a powerful tribe of Arabs from the desert opposite. About one and a half or two miles to the north-east lies the little island of Arad, merely a low sandy islet, with a few date trees upon it, and a hamlet composed chiefly of fishermen's huts. The harbour for shipping is formed between Bahrain and Arad islands, from which project extensive reefs of rocks. The depth of the harbour is from three to four and a half fathoms, with a sandy bottom. On the western and north sides of Arad, at some distance from the beach, are springs of fresh water gushing from the submarine rocks, where the salt water flows over them at the depth of a fathom or two, according to the state of the tides. Some of the fresh water springs are close by the beach, and here the fishermen fill their jars or tanks without difficulty, but many of the springs are distant from the shore; and whenever the fishermen on the bank near them require water, they bring their boat close over the spring, and one of the crew dives under the surface of the salt water with a leathern *mussuck*, or tanned skin of a goat or sheep, and places the neck or mouth of it over the spring. The force of the spring immediately fills the bag with fresh water, and the man ascends without difficulty to the surface, and empties his cargo into a tank, and he descends continually to replenish his mussuck, until the tank be filled. Captain Maughan was told that some of the springs are in three fathoms water. The mussuck they use may contain from four to five gallons; the people who generally fish about these islands are pearl divers, accustomed to dive in twelve and fourteen fathoms water for pearls. They are a quiet, and, if not molested, a harmless race of Arabs; during the summer time they wear but little clothing. There are also springs of fresh water under the sea near the north-eastern part of Bahrain island. From all that Captain Maughan could learn, above thirty springs of fresh water have been discovered in the sea in the neighbourhood of Bahrain and Arad.

The sandy beaches of the neighbourhood are composed of the usual sea-sand, chiefly composed of broken corallines and shells. The nearest high land is the coast of Persia opposite, about Cape Verdistan, Kongoon, Assiloo, &c.; and it is composed chiefly of sandstone, black coarse marble, and gypsum.

The vegetation is scanty, merely a few shrubs, mostly a species of balsam, skirting the sides of the mountains. The land about El Katiff on the main, twenty miles further to the westward of Bahrain, is of moderate height, and not of any considerable extent. All the coast to the eastward of Bahrain is very low and sandy, until it joins the mountains over Cape Mussendom.

On the Lofty Flight of the Condor.

NEXT to the Condor, the Lammergeier of Switzerland and the Falco destructor of Daudin, which is probably the same as the Falco Harpya of Linnæus, are the largest flying birds.

The region which may be considered as the habitual abode of the Condor, begins at a height equal to that of Etna, and comprehends strata of air at an elevation of from 9600 to 18,000 feet above the level of the sea. The largest individuals that are met with in the chain of the Andes of Quito, are about fourteen feet from the tip of one wing to that of the other, and the smallest only eight. From these dimensions, and from the visual angle under which this bird sometimes appears perpendicularly above our heads, it may be judged to what a prodigious height it rises when the sky is clear. When seen, for example, under an angle of four minutes, it must be at a perpendicular distance of 6876 feet. The Cave of Antisana, situated opposite the mountain of Chussulongo, and from which we measured the bird soaring, is situated at a height of 12,958 feet above the level of the Pacific Ocean. Thus, the absolute height which the Condor attained, was 20,834 feet, an elevation at which the barometer scarcely rises to 12 inches. It is a somewhat remarkable physiological phenomenon, that this bird, which for hours continues to fly about in regions where the air is so rarefied, all at once descends to the edge of the sea, as along the western slope of the volcano of Pichincha, and thus in a few minutes passes as it were through all the varieties of climate. At a height of 20,000 feet, the air-cells of the Condor which are filled in the lowest regions, must be inflated in an extraordinary manner. Sixty years ago, Ulloa expressed his astonishment at the circumstance that the vulture of the Andes could fly at a height where the mean pressure of the air is only 14 inches.* It was then imagined, from the analogy of experiments made with the pneumatic machine, that no animal could live in so rare a medium. I have seen the barometer fall on Chiniborazo to 13 inches $11\frac{8}{10}$ lines. My friend, M. Gay Lussac, respired for a quarter of an hour in an atmosphere whose pressure was only $0^{m}.3288$. At heights like these, man in general finds himself reduced to a most painful state of debility. In the Condor, on the contrary, the act of respiration appears to be performed with equal ease, in mediums where the pressure differs from 12 to 30 inches. Of all living beings, it is without doubt the one that can rise at will to the greatest distance from the earth's surface. I say, at will, because small insects are carried still higher by ascending currents. Probably the height which the Condor attains is greater than that which we have found by the calculation mentioned above. I remember that on Cotopaxi, in the Plain of Suniguaicu, covered with pumice, and elevated 13,578 feet above the level of the sea, I perceived that bird at such a height, that it appeared like a black dot. What is the smallest angle under which objects weakly lighted are distinguished?† The diminution which the rays of light undergo by passing through the strata of the atmosphere, has a great influence upon the minimum of the angle. The transparency of the air of mountains is so great under the equator, that, in the province of Quito, as I have elsewhere shewn‡, the poncho or white mantle of a person on horseback is distinguishable at a horizontal distance of 84,032 feet, and consequently under an angle of 13 seconds.

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* Astronomical observations made by order of the King of Spain, p. 109.

† It is probably one minute. In 1806, a balloon, which was four fathoms in diameter, was seen with the naked eye at Berlin to fall at a distance of 40,200 feet. It was then under a vistual angle of 2′4″. But it could have been distinguished at a much greater distance, notwithstanding the constitution of our northern atmosphere.

‡ In my memoir on the diminution of heat, and on the lower limit of perpetual snow.

Humboldt, Tableaux de la Nature, t. ii. pp. 72—78.

Notes in regard to the Geology of Cherry Island and Spitzbergen. By Professor Keilhau of Christiania.

The great primitive land of Scandinavia continues onwards to the extreme point of Norway; but in this high latitude, some newer formations make their appearance among the older. The *sandstone-quartz* of Alten has been known since the travels of the celebrated Von Buch. On the east, towards the Russian dominions, there is a considerable district which deviates more from the primitive formation than the sandstone-quartz of Alten does. *Sandstone* and *conglomerate* extend across the subjacent gneiss in a horizontal position, and here we do not meet with the well known Norwegian and Swedish transition rocks, but what appear to be secondary deposites. Notwithstanding, it is difficult to refer to its proper place this sandstone of East Finmark. Neither beds of limestone nor organic remains have been met with in it, yet it is probably nearly allied to the "old red sandstone." The porphyry and amygdaloid of this formation are here represented by *claystone* and *jasper.*

Hence, in Eastern Finmark, we find ourselves on the edge of a great secondary basin. The first land which rises above the level of the ocean in the Arctic Sea, beyond the North Cape, is the small Cherry Island (Bear Island) in north latitude 74° 30′, which is entirely composed of secondary rocks, horizontally stratified, and cut perpendicularly on the coast into cliffs. The rocks are principally *sandstone* and *limestone.* The limestone abounds in petrified sea-shells, and in the sandstone he discovered a bed of *coal* from two to four feet thick. Further to the north, the depth of the sea is so inconsiderable and uniform, that the seamen, after seeing the horizontal strata of Cherry Island, conclude that they continue on their course northward, to sail over the horizontal basis of Cherry Island, over beds which are visible on *Hope Island*, and the Archipelago of the *Thousand Islands.* These beds are said to be of a soft *blackish clay-slate.* The Thousand Islands lie off East Spitzbergen. Here there is a lofty extensive table-land very steep towards the sea. Already at the distance of half a degree of latitude, a horizontal stratification is announced by a layer of snow, resting on a black wall of rock. On approaching towards the west side of Stansforeland, between 77° and 78° N., the lowest bed at a distance appears to be basalt. It proved to be a coarse *granular trap-rock,* split by means of vertical rents into imperfect columns. This bed forms a flat extent of coast, about ten miles and a quarter broad, and forty-one miles long, and is the base or fundamental rock of an alternation of fine granular *sandstone,* an arenaceous *marl-slate,* compact *siliceous limestone,* and frequent repetitions of the *trap-rock.* Organic remains were not discovered either in the sandstone or limestone. This same formation appears to extend to north latitude 80°, and probably forms the greater part, if not the whole, of East Spitzbergen. It is true some boulders were met with, which point at primitive rocks, viz. a rounded mass of gneiss. But these boulders may have come from West Spitzbergen, which furnishes a great primitive chain.

An interesting deposit of *shell-clay* was observed at Stansforeland, in which the shells (*bivalves*) were of the same kind as found in a similar clay in the southern parts of Norway. This deposite extends onwards nine miles and a half from the shore, and rises one hundred feet above the present level of the sea. The heaps of whalebones found at a considerable height on the Thousand Islands may stand in connexion with this appearance.

The *primitive rocks* of West Spitzbergen appear at the South Cape in lat. 76½°. They are *mica-slate,* with numerous beds of quartz. In *Horn Sound* and *Bell Sound* these rocks form the high land; and, to judge from the form of the mountains, these or other primitive rocks ascend higher on the west coast. The primitive rocks, where examined at the South Cape, were perpendicular, with a direction from N. E. to S. W. Towards the east, lay a formation over the very limited primitive district, which certainly belonged to that of Stansforeland.

A new formation occurs westward along the sea-coast, in fiords, under the high chain, and in small flat islands, which lie in front of the coast. There appears to be but feeble traces of the transition period, but more evident symptoms of secondary deposites. In the year 1826, sea-horse fishers from Finnmark brought *sixty tons of coal* from Eissund, in north lat. 78°.

The coal of Spitzbergen, which extends beyond north latitude 79°, resembles *cannel coal.* The *gypsum* also, which occurs extensively in many parts, belongs to the secondary rocks of this coast. Specimens of it can easily be procured in Finnmark. Very far towards the north, on the west side, limestone occurs extensively distributed: it is possible that it may belong to the primitive chain, if this stretches out so far, but more probably it is of newer formation.

From what is known of the east coast of Greenland, it appears, between north latitude 71° and 72°, to resemble Spitzbergen so much, that we may place there the western boundary of a particular territory, which is bounded on the south by the Scandinavian primitive mountains; but on the east embraces a part of Nova Zembla, and may extend forward to the Strait of Waigatz.

N. B.—The preceding observations were delivered at the meeting of Naturalists in Berlin, in September 1828, by the active and enterprising traveller Keilhau himself.

Is the Domestic Cat originally a native of this Country?

It has for years been a question with naturalists—Is the Wild Cat of Europe the original of our Domestic Cat? Some have referred all the varieties of the house cat to our wild cat; others, as Brehm, Fleming, &c., rejecting this opinion, maintain that the house, or domestic cat, belongs to a wild species no where found in Europe, and that the European wild cat is a peculiar and distinct species. In the former volume of the Journal, vol. vii. p. 369, we noticed the discovery of a species of cat in Nubia, by Rüppel, the *Felis maniculata,* which he regards as the original stock from which the domestic cat of the Egyptians was derived, and whence, probably, alsosprung the domestic cat of Europe. This opinion we consider as probable. However it may turn out as to the species from which the domestic cat originated, there can be little doubt of its being different from our common wild cat, *Felis Catus.*

When we examine the wild cat, we find that it is much larger, has a stronger make, is more powerful, and has a shorter and thicker body and head, than the domestic cat. These distinctions shew that the two animals cannot well be considered as belonging to the same species. The great size of the wild cat, in comparison with the tame cat, intimates that they are very different from each other. All wild animals, by domestication, become stronger and larger, which is the reverse of what we observe in the domestic cat. The wild cat, if the domestic cat is derived from it, has become smaller by domestication, which is contrary to all experience, in regard to other animals. A principal proof that the tame cat is not derived from the wild cat, lies in the differences of the tail in these two animals. That of the wild cat is strong, and of nearly uniform thickness, and as if cut off at the end; further, is provided with a tuft of hair and three dark rings, while that of the domestic cat is proportionally much longer, more slender, gradually terminating in a point, and is provided with more than three rings. Further, when we compare the skeleton of both cats, we find, besides other considerable differences, that the tail of the domestic cat has more vertebræ than that of the wild cat.

Where such marked differences occur, we cannot hesitate in believing, that the domestic cat has not originated from our wild cat. If the *Felis maniculata* of Rüppel is the original of our domestic cat, then it follows that probably it was brought at an early period from Nubia into Egypt, from thence to Greece and Italy, and, in course of time, was spread over other countries in Europe. Hence, probably our domestic cat originated in the East, from whence we have obtained the most of our domestic animals.*

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* Dr Fleming, in his "British Animals," page 15, says, "It is generally believed by naturalists, that the wild cat is the parent stock of the *Felis Catus*, var. *domesticus*, or common house cat. Several circumstances appear to be at variance with this supposition. The tail of the domestic cat tapers to a point, while in the wild cat it terminates abruptly. The head, too, is larger in proportion to the body. The size is much smaller, a character at variance with the ordinary effects of domestication."

Account of a new species of Mineral named Polybasite, and Observations on Zinkenite.

This mineral has been hitherto confounded with the Sprödglaserz, but is distinguished from it by form and composition. Rose was the first to point out the difference of this species from Sprödglaserz, and communicated to his brother H. Rose the following observations:—The crystals of this new species are regular six-sided prisms, which are commonly low and tabular, and terminated on the ends by planes perpendicular to the axis of the prism. The lateral planes are transversely streaked, and meet under 120°. The planes perpendicular to the axis are streaked in a direction parallel to the planes of an equilateral triangle, or parallel to the alternate terminating edges of the six-sided prism. Hence it follows, that the crystal must be rhomboedral. The fracture is uneven. The crystals are iron black; lustre splendent both on the fracture and external surfaces. Colour not changed in the streak. It is sectile; hardness between that of rock salt and calcareous spar. Specific gravity of a variety from Durango in Mexico is = 6.214, at temperature of 10°5. R.

The Polybasite occurs partly in superimposed crystals, partly massive and disseminated. It occurs in veins in the mines of Guanaxuato in Mexico; also at Guarisamey in Durango, in the same country, with crystallized copper pyrites and calcareous spar; and also with stilbite, as at Andreasberg in the Hartz. Probably the six-sided tables, streaked on the terminal planes, from the mine Morgenstern near to Freyberg, belong to this species.

Werner's description of Sprödglaserz includes two six-sided prisms; one, which, when carefully examined, as has been done by Mohs, proves to be an oblique four-sided prism, with truncated acute lateral edges, and this is the Sprödglaserz of Mohs; the other, which is a regular six-sided prism, is the present species the Polybasite. The Polybasitc of Guarisamey, in Durango, in Mexico, affords the following constituent parts:

Sulphur, 17.04; antimony, 5.09; arsenic, 3.74; silver, 64.29; copper, 9.93; iron, 0.06 = 100.15. The portions of sulphur taken up by the antimony and arsenic, for the sulphuret of antimony and sulphuret of arsenic, are = 1.90 and 2.40; altogether 4.30. The silver takes up 9.56 of sulphur, in order to form the sulphuret of silver, and the copper 2.53 sulphur to form the sulphuret of copper. The quantity of sulphur is three times greater in the electro-positive metallic sulphurets than in the electro-negative; the quantity of sulphur in the sulphuret of silver and sulphuret of copper is as 4 : 1. The formula for the compound can therefore be expressed as follows:—

$$\text{Cop. }9.\left\{\begin{matrix}\overset{m}{S}b\\ \overset{m}{A}s\end{matrix}\right. + 4\ A\ 9^{9}\left.\vphantom{\begin{matrix}\overset{m}{S}b\\ \overset{m}{A}s\end{matrix}}\right\}\begin{matrix}\overset{m}{S}b\\ \overset{m}{A}s\end{matrix}$$

In this compound, therefore, the sulphuret of antimony and the sulphuret of arsenic are combined with the greatest quantity of base, and hence the name Polybasite, given to this species, from πολυς and βασις.

Zinkenite.—Rose refers this mineral species to the prismatic series of Crystallisation, and Hartmann, in his interesting popular Lectures on Mineralogy, does the same. Lately, the last mentioned author informs us, that he has fully confirmed this opinion, by finding crystals in the form of rhomboedral prisms, bevelled on the extremities; the bevelling planes set straight on the acute lateral edges of the prisms; the crystals grouped as in arragonite. In opposition to this statement, we have that of Mohs, (in Partsch's Catalogue of the Vienna Imperial Cabinet), and of Haidinger (Anfansgrunde der Mineralogie), who maintains that Zinkenite belongs to the Rhomboedral System.

On the Egg of the Ornithorynchus.

M. Geoffroy St Hilaire lately communicated to the Academy of Sciences, a letter containing the figure and description of an Ornithorynchus's egg. At the same time, he made some remarks on the discussions which have arisen among the naturalists of Europe, respecting the classification of the group of *Monotremata*, comprehending the *Echidnæ* and *Ornithorynchi*. Most naturalists refer these singular animals to the class of mammifera, and consider them as viviparous. M. Geoffroy St Hilaire, however, has always believed these animals to be oviparous, and to constitute of themselves a fifth class, entirely different from the mammifera. For a moment, however, the question seemed to be decided against him. M. Meckel imagined that he had found mammæ in the ornithorynchus, and described the texture of these organs. M. St Hilaire, however, maintains, that, notwithstanding M. Meckel's ability as an anatomist, he had been deceived on this point, and that what he had taken for mammæ was something else. When this information reached us, we wrote to an intelligent friend on the subject, and the following is his answer to our queries:—

" Your informer probable goes too far, when he says that I have seen and examined the egg of an Ornithorynchus. I have examined the shells of two eggs in the possession of Mr Leadbeater here, and brought from New Holland as those of the Ornithorynchus. You are aware that M. Murdoch, and other travellers, have maintained that they have seen the eggs of this animal, and that Mr Hill declared, that, in dissecting a female, he found a small yellow egg in the left ovary. Geoffroy St Hilaire has lately confuted the details of Meckel about the mammary glands, and considers these organs of the Ornithorynchus as of the same nature with the odorous glands of the squirrels. The day before I left Paris, in September last, that venerable anatomist mentioned to me, that he was perfectly convinced that the ornithorynchus is a true *oviparous reptile*, from his examination of its structure, and particularly from its organs of generation. As you might expect, Geoffroy St Hilaire felt a deep interest in my news about the eggs at present exhibited in London and Manchester, as those of this animal, and he entreated me to send him soon whatever information I could obtain regarding them, or to procure for him a specimen.

" Two of these eggs are in the possession of Mr Leadbeater, F. L. S. of Brewer Street here, and two are preserved in the Museum of Manchester, as I am informed by him. The whole four were brought from New Holland by Holmes, a collector of objects of natural history, who has resided many years in that country, and who is known to some naturalists in London. They were brought along with a number of Australian birds to Mr Leadbeater, who has a splendid collection. Mr Holmes was shooting on the banks of the Hawksburgh River, a great way up the country, when he saw an ornithorynchus rise a few feet before him, and escape into the river: he saw the animal distinctly, and knew it well. On examining the spot where it had been sitting, he found a depression about 9 inches diameter in the sand, and the four eggs in question lying in that hollow.

"The eggs are certainly not those of a bird, but they very closely resemble in form and size those which I have found in many Saurian and Ophidian reptiles, not a tenth part of the size of an ornithorynchus. They have not a thick and a narrow end like most birds' eggs, but have a cylindrical form, suddenly rounded at the extremities, and are of equal thickness at both ends, precisely like those in the oviducts of several reptiles before me. The shells only are preserved, and one of them is broken, which shows its inner surface. They have a uniform dull white colour, and are much more thin and translucent than birds' eggs of the same size. They measure $1\frac{3}{8}$ inch in length, and $\frac{5}{8}$ths of an inch in breadth. When we examine the outer surface of the shell with a lens, in place of finding the uniform opacity and compact texture of a bird's egg, we observe that the calcareous matter is so deposited in the membrane, as to present a beautiful reticulated or cellular appearance, not by the formation of actual cells, for the surface is quite smooth and uniform, but merely by the white opaque earthly matter having so disposed itself in the transparent membrane, as to appear like so many minute cells, with a transparent centre. The inner surface of the broken shell does not present this reticulated *appearance*, the white earthy matter being there deposited in separate particles, and giving the whole a minute granular appearance, when viewed through a lens.

"This is not the kind of information you expected to receive about the eggs of this remarkable animal, which Lesson considers as a bird, Cuvier as a quadruped, and Goeffroy as a reptile, and I am sure it is not that kind which I should have been delighted to have been able to communicate to you."

On the Philosophy of Nature.

M. Geoffroy St Hilaire read lately to the French Academy a memoir, entitled *Meditations on Nature.* He began with general considerations respecting the new branch of science cultivated in Germany, and which has been called the *Philosophy of Nature.* He pointed out the course pursued by the partisans of this philosophy, which has not only been publicly taught, but is professed by men of profound knowledge. The *philosophers of nature* have two objects in view: 1*st*, That of associating in their conceptions the whole of the phenomena of nature; 2*dly*, That of arriving at these conceptions, not by deductions *a priori* derived from the observation of particular facts, but by original views.

The author shewed the risk there is in following such a course, and how easily those who pursue it may fall into error. He did not deny, however, that a man of genius might, by means of it, do great service to science.

Kepler proceeded in almost all his astronomical investigations according to the inspiration of his genius, without waiting for the results of observation. Tycho, his master, warned him to give up these *vain speculations.* The advice was excellent. "But," says Delambre on this subject, in the Biographie Universelle, "what should we have lost, had it been followed? Such conduct, it was said, was folly; but to this folly Kepler owed his glory, for it led him to the discovery of his immortal laws. This temerity gave to the genius of Newton the means of arriving at the proposition, that *every particle of matter gravitates to every other particle, with a force inversely proportional to the squares of the distance,* the most important law of philosophy. Assuredly, when this law, which is now the foundation-stone of all physics, was conceived and reduced to this state of sublime simplicity, it was the genius alone of Newton, proceeding upon the theories of Kepler, which could elicit it.

The author then gave a concise view of the principal opinions entertained by the partisans of the philosophy of nature. Then, speaking of an assertion made by several of them, who have represented his own investigations in general, and in particular his idea of the unity of organic composition, as a proof of the great results to which a conception *a priori* might lead, he protested against such an assertion; and, after giving an account of his discovery, shewed that it was the result of the generalization of a series of particular researches, and of observations made with all due care.

It was by following this course that the author succeeded in placing his law of the unity of organic composition among the number of established principles. The details into which he entered on this subject appear to us worthy of attention.

He first replied to those who think they see some resemblance in his principles of the unity of organization to the old idea, that all the beings of nature were *created in view of each other*, and shewed how his great principle differs from this hypothetical and insignificant proposition.

But, it will be said, is not the philosophical resemblance of animated beings an idea that has been debated since the days of Aristotle? Undoubtedly it is; but the question was far from being solved: and the author himself, when he took it in hand, set out from considerations which would have led him *a priori* rather to admit two types of organization than one only. Considering the important office which respiration performs in the life of organized beings, and struck with the incontestible idea that the food is only converted into animalized substance, in consequence of the phenomena of respiration, and under its influence, he would have been led to think that organized beings separate into two very distinct classes, according as they respire in media so essentially different as air and water. But observation, and observation alone, apprised him that this is not the case, and that there is only a single being capable of being modified according to circumstances, so as to live in air or in water.

Consider the vertebrate animals, for example: they are evidently constructed in a twofold point of view. Their embryo presents the principle of two respiratory organs, so that if these organs are equally developed, as in the amphibia, they exist together in the adult animal without injuring it, and, on the contrary, serve it successively in their respective medium. Let one of these organs predominate over the other, there results an animal breathing in the air or a fish. And wherever, in this very case, the predominant system does not stifle the other entirely, there always remain traces of the latter, the existence of which is sufficient to attest the twofold original design, and whose development, limited as its uses, so far from hurting the free exercise of the opposite system, enriches it with constantly useful aids.

The author then spoke of his researches respecting insects. He dwelt particularly on his numerous investigations on the subject of monstrosity, on those by means of which he succeeded in shewing that all the cases of monstrosity, formerly considered as lusus or sports of Nature, on the contrary furnish so many proofs of the constancy of her laws. It was especially in consequence of this examination that the author arrived at this entirely unexpected result, which very happily solves the difficulties, and explains them in a perfectly natural manner: that *it is not the organs themselves*, but the materials of which the organs are composed, that recur in all animals in invariable positions, which are in short always and decidedly similar.

"There results from this recital," said the author in concluding, "that, if we believe in the determinate existence of certain organic materials, in that of a very small number of laws for arranging them, in a prescribed and necessary order of arrangement, and consequently in the philosophical similarity of beings, and, finally, that if we have made of these propositions, extended to all their identical cases, the subject of an abstract and general principle, we have not at least conceived it before examining facts, but we have, on the contrary, adopted it as the result of long and laborious researches." *Le Globe.*

Observations on the Daily Periodical Growth of Wheat and Barley. By M. Ernest Mayer, Professor at Königsberg.

The author, who distinguishes himself as well by the accuracy of his observations as by the philosophical direction which he gives them, had already made known to us the rapidity of growth of the stalk of *Amaryllis belladonna* *, which is such that it may even be followed by the eye, and is much quicker during the day than during the night.

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* Mem. de la Soc. Horticult. de Berlin, t. v. p. 11[illegible]

The stem of bulbous plants, which only bear at their summit a single flower, or a single bunch of flowers enveloped in a spatha, is without doubt the organ best suited for observations of this kind, not only because its growth is very rapid, but also because the bulb presents a fixed base, and the origin of the spatha a determinate summit. But as the author was sensible that no important result could be obtained otherwise than by the comparison of a pretty large number of observations made in nearly similar circumstances, and as he could not easily procure a sufficient number of individuals of this kind, he resolved to make his experiments upon gramineæ, and consequently upon leaves.

After planting in flower-pots seeds of *wheat* and *barley*, which he placed three and three in each vessel, he selected for his experiments four pots, containing six plants of wheat and barley, which appeared to him the nearest to each other in size. These vessels were placed in a very light room, heated once a day at six in the morning, by means of a large earthen-ware stove. The shutters of the apartment were hermetically closed every evening, and were opened again at day-break. A Reaumur's thermometer, placed near the window at the height of the vessels, marked the temperature of the apartment, and was consulted each time that the plants were measured.

The observations commenced on the 11th March, at eight in the evening, and continued till the 16th March, at eight in the morning. During this period of five nights and four hours, the weather was in general cloudy and soft, and the sun appeared only on the morning of the 14th. The external temperature of the atmosphere, of which the author gives a table, presents the following general result:

At 7 in the Morning.		At 3 in the Afternoon.	
Max.	Min.	Max.	Min.
+ 2°.	— 0°.25.	+ 4.°00.	+ 1°.45.

The temperature of the apartment never rose above + 17°.50, and never fell below + 14°.00; which gives a mean of + 15°.75. The author also gives a table of the state of the temperature of the room for each observation; and remarks that the gradual progress of the temperature of the apartment, although artificial, was yet more or less in connexion with the motions of the external temperature; for the temperature of the apartment attained its minimum between five and six in the morning, at the moment when the stove was lighted; it increased rapidly, until two or three in the afternoon, and then gradually fell back to its minimum.

To measure the growth of the plants, the author made use of a Paris foot divided into inches, lines, and quarter lines. This instrument was furnished with a sufficiently broad base to let it be placed upon the earth in the pots, as near as possible to the plants, and always in the same place. The plants were constantly placed and measured in the same order, and at the same hours. The author having always measured to the summit of each plant, has necessarily comprised in his appreciations of growth, organs of different knots in various degrees of development. The *cotyledon*, or first leaf of the gramineæ, rises from the ground to the height of about an inch before the second leaf can be perceived, which rises from the former by the first leaf. Thus he began with measuring up to the point of the *first* leaf or cotyledon; then, when the second was visible, to the point of this *second* leaf, and *lastly* to the point of the third. The internode of the first leaf had ceased to grow, the internode of the second was still growing, and the third was only beginning to shoot.

The wheat plants *a*, *b*, *c*, of the vessel No. 1, and the barley plants *g*, *h*, *i*, of the vessel No. 3., had their cotyledon almost entirely developed, when they began to be measured. The plants of the vessels Nos. 2. and 4., on the contrary, scarcely shewed themselves above ground, and their second leaf did not become visible until the 13th, although the seeds had been sown on the 7th. On the 16th, in the morning, the third leaves of the three plants of wheat of the vessel No. 1., and of the two barley plants of the vessel No. 4. (the third having perished) had attained nearly the third of the limb of the second leaf, which continued to grow, while the third leaf of the barley plants of the vessel No. 3. had already attained the half of the limb of the second leaf; lastly, the three plants of the vessel No. 2. had not yet shewn their third leaf.

These details may appear unnecessarily minute, but they prove the scrupulous accuracy of the author, and shew what degree of confidence his observations deserve.

They are followed by a table, in which the author has consigned every two hours, from eight in the morning to ten at night, the total height which each wheat and barley plant had attained, from its base to its summit. The growth observed during the hours of the night is also marked for each plant. This table contains 383 observations marked in *inches*, *lines* and *fourths of lines*. The author himself has extracted from this table the principal data to form another, which we here copy, and which presents the means of the periodical growth of each plant for each of the six periods of the day, consisting of two hours, and for the night period of twelve hours.

Mean of the Periodical Growths of the Plants of Wheat and Barley.

	In Pot No. 1.			In Pot No. 2.			In Pot No. 3.			In Pot No. 4.	
	a.	*b.*	*c.*	*d.*	*e.*	*f.*	*g.*	*h.*	*i.*	*l.*	*m.*
From 8 P. M. to 8 A. M.	6.75	6.93	6.31	5.31	4.56	4.31	5.18	5.50	5.31	4.31	4.31
10 A. M.	1.68	1.93	1.25	1.00	1.18	0.93	1.31	1.50	1.06	1.00	1.18
12 A. M.	1.06	1.25	1.43	0.87	0.81	1.18	1.00	0.81	0.93	0.68	0.93
2 P. M.	1.43	1.37	1.18	1.00	1.31	1.12	0.87	1.25	1.00	1.25	1.31
4 P. M.	1.68	1.31	1.37	1.31	1.18	1.56	1.12	1.06	1.25	1.25	1.31
6 P. M.	0.87	1.00	0.75	0.87	0.62	1.00	0.62	0.87	0.50	0.87	0.81
8 P. M.	1.06	1·00	1.06	0.43	1.06	0.37	0.87	0.62	0.81	0.81	0.75
Total of growth.											
From 8 A. M. to 2 P. M.	4.17	4.55	3.86	2.87	3.30	3.23	3.18	3.56	2.99	2.93	3.42
2 P. M. to 8 P. M.	3.61	3.31	3.18	2.61	2.86	2.93	2.61	2.55	2.43	2.93	2.87
8 A. M. to 8 P. M.	77.88	7.86	7.04	5.48	6.16	6.16	5.79	6.11	5.42	5.86	6.29

These measurements are in fourths of lines, and their centesimal fractions.

Far from being surprised at the anomalies which this table presents, in the periodical growth of the eleven plants compared together, one is astonished at not finding these anomalies greater, when he recollects, 1*st*, That the plants were not of the same species; *2dly*, That they were in different stages of evolution at the period when the experiments commenced, and that some of them had even ceased to grow before the end of the experiment.

The following are the general results which the author deduces from his observations.

1st, The growth was generally more accelerated during the twelve hours of day, than during the twelve hours of night.

2dly, The growth was generally more rapid from eight in the morning to two afternoon, than in the subsequent period of six hours.

3dly, The growth of each plant presents daily two periods of *acceleration* and two periods of *retardation* ; the first acceleration shews itself between eight and ten in the morning, the second between noon and four.

Thus when the total growth in length of a plant of barley is 11‴.76 in the twenty-four hours, this increase will be distributed periodically as follows :

From 8 A. M.	to 10 A. M.	-	1.27	3.45°	6.42
10	12	-	0.99		
12	2 P. M.	-	1.19		
2 P. M.	4	-	1.30	2.97	
4	8	-	0.79		
6	8	-	0.88		
8	8 A. M.	-	-		5.34
					11.76

The author also deduces from his table the means of the total growth of each of the plants taken separately, from eight in the morning to ten at night, and he estimates the means of all these individual growths during the same period at 0″.80.

The most remarkable circumstance which this series of observations and calculations presents, is without doubt the *alternate* acceleration and slackening, which takes place three times a day, in the morning, shortly after noon, and later in the evening, as well as the relation which is observed in the *intensity* of each acceleration, and of the slackening which follows it. The greatest acceleration takes place from noon to four o'clock, and is followed by the greatest slackening. The smallest acceleration takes place from six to eight in the evening ; and the slackening which immediately follows it from eight to ten, is the most imperceptible of all.

Heat is with reason considered as the principal agent of all regular vegetative growth, and we know that heat follows a regular progress in its daily increase and diminution. Moisture, although necessary to plants, does not, on the contrary, appear to be submitted to any rule of time or quantity. As to light, vegetables require it of a very high degree of intensity, before they can arrive at certain periods of their perfect development; but it is much less necessary to their growth in length. It would therefore appear of importance to compare the periodical motions of the growth of the young plants, with the variations of the internal temperature of the apartment. For this purpose, the author gives a table of its variations; but he has found little or no connection between the oscillations of the thermometer, and the oscillations observed in the growth of the young plants. The only relation which he has been able to make out between the two tables, is that presented by the circumstances that the first acceleration of the growth coincides with the most rapid ascending motion of the thermometer, between eight and ten in the morning. But this coincidence does not again present itself in the subsequent periods; and even the greatest acceleration which takes between two and four in the afternoon, happens at the moment when the thermometer begins to fall.

The author concludes his curious memoir, by observing that it is somewhat probable that these periodical oscillations of the daily growth depend upon the vitality of the vegetable alone; or that, perhaps, the cause is a complex cause; that the *periodicity* of the oscillations depends upon the *vitality*, and their *intensity* upon *external* causes. But as it would be improper to draw too positive general conclusions from the small number of observations which he has made, he proposes to continue them, and in the mean time lays before the public what he has been able to gather on this interesting subject, in the hope of exciting others to similar researches.*

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* Extract from the Linnæa, t. iv. pp. 98–113. Bib. Univers. Feb. 1829.

Plan for ascertaining the Rates of Chronometers by Signal. By R. WAUCHOPE, Esq. Capt. R.N.—Communicated by the Author.

EASTER DUDDINGSTON, PORTOBELLO,
23d November 1829.

MY DEAR SIR,

IN sending you the accompanying plan for regulating chronometers by an instantaneous signal, I may mention that the subject has occupied my attention since 1818, when I first proposed a telegraph for the purpose to the Lords of the Admiralty, and, in 1824, I again wrote on the same subject, and received a letter of thanks from their Lordships.

I now feel particularly happy in stating that their Lordships have directed a trial of the above plan to be made at Portsmouth; and, in a letter of the 12th of this month, from an officer in an official situation there, who has taken a great interest in and superintendence of the signal, he says,—"The Admiral and myself were at the King's Stairs, when a boat from a line-of-battle ship landed with her chronometers, &c. not only to set them by the clock at the Observatory, but they had brought their artificial horizon and sextant to take sights. It was blowing very fresh, and the ship I believe was waiting for this inconvenient, and after all unsatisfactory process. I then repeated to the admiral (which I had several times mentioned before) your plan, marking this as a case in point. From that moment he pursued its adoption with energy, and it is now, although in an infant operation, quite sufficiently established to give proof of *complete success.*"

Before concluding, I cannot help expressing a hope that the Edinburgh Astronomical Institution may take the plan into their consideration, as the Observatory on the Calton Hill is so admirably adapted for the purpose. A flag-staff of a very moderate height, and a ball of four feet diameter, would be perfectly well seen by all the shipping in Leith Roads; besides the advantage which would accrue to every watch-maker in Edinburgh and Leith, by giving them the power of comparing their time-pieces with true time. I may mention that that very ingenious and very excellent watch-maker, Mr Whitelaw, No.

16. Prince's Street, has stated to me, that he could, with perfect ease, adapt the Observatory clock, or any other time-piece, so as to disengage the ball at a given hour, without injury to the time-piece, which would certainly be a very great convenience. I am, &c. RT. WAUCHOPE.

To Professor Jameson.

The great importance of the chronometer, and the additional security and precision which it has imparted to the science of navigation, need not here be insisted upon. It is deeply to be regretted, however, that a discovery only second to the mariner's compass and quadrant, should still be so limited in its use among the merchant ships of this and other countries. Nor is the cause of this limitation (which is producing annually so much waste of life and property) difficult to be accounted for.

The obvious and acknowledged reason why merchant ships do not carry time-pieces so frequently as they otherwise would, is not so much owing to the expense of the instruments, as to the difficulty of obtaining a *good rate*, arising from the inability of masters of ships to obtain one, both from the great accuracy required, and the want of time and opportunity. This last cause applies to men-of-war equally with merchant ships, as it may, and does frequently occur, that ships come to an anchor even upon our own coasts, without having it in their power to get a set of observations for an artificial horizon.

It is a custom, I believe, pretty generally on board of King's ships (when a good opportunity offers) to send the time-pieces on shore for the purpose of getting a rate, which they do with considerable risk to the chronometer; and, after all, it is frequently found, that the *shore rate* and *ship rate* do *not agree*,—the cause of this disagreement arising from the same source of error to which compasses are subject, viz. the magnetic influence which the mass of iron in the ship has upon the instrument.

Many advantages would therefore accrue, could an *accurate* rate be found without moving the time-piece out of the POSITION OR PLACE in which it is to remain whilst at sea, and without the necessity of sending on shore to obtain one.

The plan I have to recommend for obviating *all* these *difficulties*, is as follows:—Suppose, at Portsmouth for instance, it was notified to all the ships at Spithead and St Helens, to merchant ships as well as to men-of-war, that a few minutes before noon, at Greenwich, a particular signal would be hoisted at the platform (a conspicuous place), and that the *instant* it was *noon* at Greenwich, it would be hauled down. This would give *every ship within sight* an opportunity of comparing their timepiece with Greenwich time, and they would by this means get a *rate far more accurately* than could be obtained with the best sextant and artificial horizon in the hands of the *most experienced observer*, as the hauling down of the signal would be regulated by the transit instrument at Portsmouth Observatory.

Should the plan be approved of, the masters attendant at the different dock-yards at home, and at the naval stations abroad, might be entrusted with the signal and transit instrument. A north and south window in any convenient store-house would answer all the purposes of an Observatory, and the whole expense would be that of the transit instrument.

The men-of-war at the different ports would always be a check upon any carelessness or inattention on the part of the master-attendant. Indeed, the known longitude of the place, and the hauling down of the signal, indicating Greenwich time, would prevent the possibility of any error. Perhaps one hour after noon might be better for the signal, to allow an observation being made to ascertain the time of day a short time before the signal is made.

The accompanying signal by means of balls, is that which has been adopted at Portsmouth, and which appears to answer perfectly *.

Notice of GOETHE's *Essay on the Metamorphoses of Plants.*

It is a remarkable fact in the history of science, that an illustrious poet who might seem exclusively devoted to moral cogitations and the arts of imagination, turning aside for a moment from his usual pursuits, and casting a glance over the vegetable kingdom, should make an important discovery. This is what happened to the celebrated Goethe in 1790. With a remarkable sagacity, he perceived the prodigious variety of the foliaceous and floral organs of plants. There exists among them so great a similarity, that each of them may be considered as a metamorphosis of some other. Far from giving credit to Goethe for this ingenious idea, the German public seems to have wished to punish him for having left his poetry, and paid little attention to his work, which was still more neglected by foreigners.

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* We shall probably in next Number of the Journal give a figure of this *signal.*

When I published my *Theorie Elementaire* in 1812, in which I designated, by the name of *degenerescence*, the same phenomenon which Goethe had named *metamorphosis*, I had not seen his work, and although, on afterwards meeting with it, I learned that I had been anticipated in this point of my theory, I was glad to find myself in accordance respecting this important view with that illustrious author. I venture to think, that this conformity of opinion, and the new proofs which I have adduced in its favour, have directed the attention of Europe and of Germany in particular towards Goethe's Essay. From this period, in fact, the work, which had been almost forgotten for twenty-three years, was better appreciated, and a new edition of it was published in 1817.

No French translation of it yet existed; but M. de Gingins has made amends for this omission, and the learned public owe him thanks, not only on account of the interest which the work possesses in respect to the higher departments of botany, but also on account of the literary phenomenon which it presents. This translation, which is written with elegance and accuracy, is preceded by a short preface, in which the translator gives a brief account of the various works that relate to the metamorphoses of the organs of plants. Some very short notes illustrative of ambiguous points are also added. But he has seen that there is no occasion for actually removing every little inaccuracy which may have escaped the poet who had become botanist for the moment. It is a work in which we ought to see the production of sagacity and genius, rather than find fault with every oversight in points of minute observation. M. de Gingins was better than any one qualified to engage in these researches. His monograph of the Lavandulæ has evinced his talent for observation, and we are happy to be able to announce here, that he is continuing his investigations and will gradually extend them to the whole family of the Labiatæ. (A. P. De Candolle). *Bibliotheque Universelle.*

Observations on the Affinities of Vellosia, Barbacenia, Glaux, Aucuba, Vivania, Deutzia, and of a New Genus of the order Rubiaceæ. By Mr DAVID DON, Librarian to the Linnean Society, Member of the Imperial Academy Naturæ Curiosorum, of the Royal Botanical Society of Ratisbon, and of the Wernerian Society of Edinburgh, &c. (Communicated by the Author).

VELLOSIA AND BARBACENIA.

THESE genera, together with *Xerophyta*, I consider as forming part of the family of *Hypoxideæ*, to which they appear to me to bear a greater affinity than to either of the other families with which they have been associated. They agree with *Hypoxideæ*, in having a monophyllous perianthium, whose tube is completely adherent to the ovarium, which is therefore wholly inferior; in the stamina being inserted in the base of the divisions of the perianthium, which are disposed in a double series; in the structure and insertion of the anthers; in their trilobate stigma; in the presence of a fleshy, epigynous disk; in their trilocular, polyspermous ovarium; and finally in the seeds being furnished with a prominent umbilicus. Their habit also corresponds better with *Hypoxideæ* than with *Hæmodoraceæ*, in which the inflorescence is panicled; and the ovarium little more than half inferior. Dr Martius, who, in his elegant work on the plants of Brazil *, has referred *Vellosia* and *Barbacenia* to the *Hæmodoraceæ*, describes their seeds as being furnished with a thin membranous testa; but, from an examination of the seeds of *Vellosia candida*, although not perfectly mature, I am led to believe that the testa, when examined in the mature seeds, will be found to be crustaceous, like that of the *Hypoxideæ*. As the consistence of this organ appears to afford the only certain mark of discrimination between some families of the great class of *Liliaceæ*, it would be highly interesting to know its structure, in the ripe seeds of *Vellosia*, *Barbacenia*, and *Xerophyta*, as, without such knowledge, whatever opinion may be advanced respecting their affinities, will still be conjectural. I have ascertained, however, that the seeds of *Vellosia* and *Barbacenia*, are furnished with a very short process, analogous to the rostelliform

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* Nov. Gen. et Sp. Pl. Bras. i. p. 13.

umbilicus of the *Hypoxideæ*. In *Hypoxis erecta*, the segments of the perianthium and the stamina are frequently eight, and, from the variation of these organs in other species of the genus, the number of stamina therefore in *Vellosia*, will appear less anomalous; but it must be observed, that, in *Vellosia*, the divisions of the perianthium are unaffected by the increased number of stamina, which vary from 6, 12, 18, to 24; thus affording a striking example of the unerring regularity of the laws of nature. Dr Martius states that the stamina are sometimes 15, and this number is easily reconcileable with a six-parted perianthium, by considering them as exhibiting a quintuplicate of the three inner segments of the perianthium only, and we should expect to find them disposed into three bundles, and not into six, which would be unnatural. We have already cited *Hypoxis erecta*, as affording an example of occasional increase in the number of stamina; but there the increase is only partial; and therefore we find that the segments of the perianthium are increased in proportion: for it appears to be a law, which Nature never departs from, that, when any of the organs of fructification suffer a partial increase only, the neighbouring parts are also affected in number; but when the increase is general, then it becomes a multiplicate of the organ to which the increased one is most analogous. The genus *Lophiola* may be mentioned as exhibiting a considerable affinity with *Hypoxis*, particularly in the structure of its seeds, which are cylindrical, ascending, and attached to the placenta, by their slightly prominent umbilicus; but the testa is scarcely crustaceous, although of a thicker consistence than in the rest of *Hæmodoraceæ*, which agree with *Irideæ*, in having a membranous testa. The chief distinction between these two families depends, as Mr Brown has shewn, on the situation of the stamina. In the *Irideæ*, the stamina are placed opposite the outer segments of the perianthium, and the anthers face outwards; while, in *Hæmodoraceæ*, the stamina are placed opposite the inner segments of the perianthium, and the anthers face inwards.

Additional Remarks.—Since the above observations were written, I have been favoured by Robert Barclay, Esq. with a ripe capsule of the *Barbacenia purpurea*, from his choice collection at Bury Hill, and from which I perceive that the seeds are compressed, cuneiform, and truncate at the apex, and narrowed towards the base, which is furnished with a protuberance, arising from an elongation of the testa and umbilical cords. The testa is coriaceous, and marked outwardly with numerous shallow furrows. The genera would seem, therefore, to constitute an intermediate group between the *Hypoxideæ* and *Bromeliaceæ*, to which last M. Kunth has referred them.

GLAUX, *L.*

Syst. Linn. PENTANDRIA MONOGYNIA.

Ord. Nat. PLANTAGINEÆ, *Juss.*

Calyx liberus, monophyllus, campanulatus, coloratus, 5-fidus: *lobis* oblongis, obtusis, concavis, æstivatione imbricatis. *Corolla* 0. *Stamina* 5, hypogyna, calycinis laciniis alterna: *filamenta* subulata, glabra, infernè compressiuscula: *antheræ* biloculares, peltatæ, basi emarginatæ, apice inappendiculatæ: *loculis* parallelis, rimâ longitudinaliter dehiscentibus. *Pollen* farinaceum. *Pistillum: ovarium* globosum, uniloculare, pluriovulatum: *stylus* teres, glaber, medio deflexus! *stigma* punctum obtusum, pruinosum. *Capsula* sphærico-ampullaris, unilocularis, 5-valvis, oligosperma, calyce marcescente basi obvoluta, et stylo persistente coronata. *Placenta* centralis, carnosa, cavitatem capsulæ implens *Semina* 5 circiter, nidulantia, hinc convexa, inde angulata, undique elevato-punctata: *testa* simplex, crassiuscula, cellularis, submucilaginosa: *albumen* copiosum, carnosum. *Embryo* axilis, teres, longitudine ferè albuminis: *cotyledones* obtusæ, brevissimæ: *radicula* cylindracea, obtusa, infera, centripeta. *Plumula* inconspicua.

Herba (littorea) *perennis, radice repente.* Caules *teretes, succulenti, erecti, subsimplices.* Folia *opposita, sessilia, ligulata, subcarnosa, integerrima, margine cartilaginea;* superiora *sæpè sparsa.* Flores *axillares, solitarii, subsessiles, rosei.*

I propose to place this genus at the end of *Plantagineæ*, where it will form the connecting link between that family and *Primulaceæ*, to which it has hitherto been referred. The simple nature of the floral envelope, the alternation of the stamina with its lobes, and the structure of its fruit and seeds, shew a marked affinity to the former, while in habit it corresponds better with the latter family. Both *Glaux* and *Littorella* agree in the insertion of stamina; and the variation in the modes of dehiscence of the capsule to be found in *Primulaceæ*, shews that this character can only be considered of generic importance. The floral envelope of *Plantagineæ* is clearly a calyx, and the scales at its base are to be regarded as bracteæ, which are also present in *Primulaceæ*. The nature of the albumen, when present, and the direction of the radicle, appear to afford the only discriminative marks between the *Plantagineæ* and *Plumbagineæ*. The anthers of *Plantago* and *Lysimachia* are terminated by a small membranous appendage, analogous to that of the *Compositæ*. Some analogies might be pointed out between *Glaux* and *Thymelæa*, but hardly amounting to an indication of affinity.

AUCUBA. *Thunb.*

Syst. Linn. DIŒCIA TETRANDRIA.

Ord. Nat. LORANTHEÆ, *nobis.*

Calyx arctè adhærens: *margo* parùm elevatus, 4-dentatus: *dentibus* obtusis, brevissimis. *Petala* 4, decidua, dentibus calycinis alterna, margini disci elevati carnosi 4-angulati inserta, ovata, acuminata, carnosa, margine hinc truncata, utrinque minutè papillosâ, æstivatione valvatâ, apice induplicata. *Stamina* 4, petalis opposita? *Ovarium* cylindricum, tubo calycino arctè obvolutum, uniloculare: *ovulo* solitario. *Stylus* brevissimus, crassus, teres. *Stigma* capitatum, crassum, carnosum, viscidum, obsoletè bilobum. *Bacca* carnosa, monosperma, stylo persistente coronata. Cætera ignota.

Arbor (Japonica) *inermis, sempervirens:* ramis *more* Loranthi *aut* Visci *dichotomis v. verticillatis.* Folia *opposita, petiolata, ovato-lanceolata, acuminata, dentata, costâ prominenti, reticulato-venosa, coriacea, glabra, lucida, pallidè viridia, luteo-maculata.* Petioli *semicylindrici.* Flores *paniculati, parvi.* Paniculæ *plures, spiciformes, pedunculatæ.* Pedunculi *villosiusculi.* Bracteæ *lanceolatæ, membranaceæ, pallidæ, caducæ. Calyx adpressè pilosiusculus.* Petala *atrosanguinea.*

Obs.—Gemmæ magnæ, angulatæ squamis conduplicatis imbricatæ, folia ampla dentata venosa, atque petioli ramis basi dilatatâ articulati, analogiam cum Fraxino commonstrant.

This genus was included by Jussieu in his order *Rhamni*; but, from its having no affinity whatever to either of the families into which that order has been since divided, its place in the system has remained undetermined: and perhaps also, from its want of novelty, the plant has been despised by botanists, and its characters and affinities consequently overlooked. Like the *Salix babylonica*, too, we possess only one sex of the tree in Europe, and that the female; which circumstance has likewise prevented its being accurately examined. The structure of the female flower agrees so exactly with that of *Viscum*, that, notwithstanding the different mode of growth of the two genera, and the absence of more accurate details respecting the male blossoms, and the ripe fruit, its arrangement among the

Loranthecæ appears fully justified; and I have no doubt that it will ultimately be found to form the connecting link between the *Araliaceæ* and that family.

LIPOSTOMA.

Syst. Linn. TETRANDRIA MONOGYNIA.

Ord. Nat. RUBIACEÆ, *Juss.*

Char. essent. *Calyx* 4-fidus. *Corolla* tubulosa, 4-loba. *Capsula* opercularis! polysperma.

Calyx limbo 4-partitus. *Corolla* basi tubulosa, fauce ventricosa, campanulata, limbo 4-loba: *tubo* intùs supernè barbato: *lobis* ovatis, patulis, æstivatione valvatis (hinc limbus inexplicatus tetragonus). *Stamina* 4, corollæ lobis alterna, faucique inserta: *filamenta* compressa, glabra, infernè cum tubo corollæ connata: *antheræ* lineares, medio insertæ, versatiles: *loculis* basi parùm divergentibus; *valvulâ exteriore* majore. *Ovarium* biloculare, calycis tubo arctissimè adhærens, apice prominulum, emarginatum, subinde bicallosum: *disco epigyno* planiusculo, suborbiculato: *ovulis* in quoque loculo plurimis. *Stylus* capillaris, glaber. *Stigmata* 2, subulata, undique papilloso-hispidula. *Capsula* globosa, bilocularis, opercularis! septo medio membranaceo sæpiùs disrupto unilocularis, polysperma: *operculo* planiusculo, deciduo. *Placentæ* 2, sphericæ, stipitatæ, septo infra medium insertæ: *stipite* compresso, adscendenti. *Semina* parva, confertissima, angulata, scabra: *testa* membranacea: *albumen* copiosum, corneum. *Embryo* axilis, erectus, lacteus: *cotyledones* oblongæ, plano-convexæ: *radicula* cylindracea, obtusa, infera, cotyledonibus parùm longior.

Herbæ (Brasilienses) *diffusæ, pilosæ.* Folia *opposita, petiolata.* Stipulæ *subulatæ, interpetiolares.* Flores *sessiles, capitati, bracteolis interjecti.* Capitula *pedunculata, solitaria, axillaria.* Corolla *cærulea.* Ovaria *sæpiùs abortientia.*

1. L. *capitatum*, pilis patulis, foliis subrotundis.

Æginetia capitata.—*Graham, in Edinb. New Phil. Journ. for April* 1828, p. 389.

Hedyotis campanuliflora.—*Hook, in Bot. Mag.* t. 2840.

Hab. in Brasiliâ. *Sello.* ♃ (v. v. c. et s. sp. in Herb. Lamb).

Herba habitu *Pomacis*, perennis, procumbens, diffusè ramosissima, tota hirsutissima: *pilis* simplicibus, patulis. *Caules* teretes, nunc purpurascentes, palmares v. spithamæi, aut dodrantales. *Folia* opposita, petiolata, subrotunda, undulata, nervosa, pollicaria, suprà gramineo-viridia, subtùs pallidiora, nitidissima, venis arcuatis prominulis. *Petioli* semiteretes, basi annulo prominulo connati, brevissimi, vix 3 lineas longi. *Stipulæ* subulatæ, interpetiolares, petiolis longiores. *Capitula* axillaria, solitaria, longè pedunculata. *Pedunculi* bipollicares. *Corolla* majuscula, amœnè cœrulea, fauce lutea, extùs pilosa. *Capsulæ operculum* calycis limbo connatum, simulque deciduum. *Semina* fusca, hinc convexa, inde compresso-angulata, undique tuberculata.

2. *L. sericeum*, pilis adpressis, foliis ovatis acutis.

Hab. in Brasiliâ. *Sello.* ⊙ (v. s. sp. in Herb. Lamb.)

Planta tota pilis adpressis vestita, subsericea. *Radix* fibrosa, annua. *Caulis* semipedalis, divisus. Rami teretes, patuli. *Folia* opposita, petiolata, ovata, acuta, membranacea, basi parùm attenuata, pinnatè nervosa, costâ mediâ subtùs prominulâ nervisque alternis oppositisve subarcuatis instructa, sesqui- v. bipollicaria; *juniora* subsericea. *Petioli* semicylindrici, vix unciales, basi annulo connati. *Stipulæ* setaceæ, petiolo duplò breviores. *Capitula* duplò minora, pedunculata. *Pedunculi* capillares, folio longiores, sericeo-pilosi. *Calycis dentes* setaceæ. *Corolla* pauld minor, pilosa, calyce duplò longior. *Capsulæ operculum* liberum, nec calycis limbo connatum. *Semina* triquetra, atrofusca, elevato-punctata.

I was led to investigate this genus, from remarking the striking resemblance of *Lipostoma capitatum* to *Pomax umbellata*, and the result has proved that there really exists a very considerable degree of affinity between these two plants, and that they form, as it were, the links connecting the *Rubiaceæ* to the *Opercularinæ*, which Mr Brown is disposed to keep united; and, indeed, I cannot see by what characters the *Opercularinæ* can well be separated, unless as a section only, as Mr Brown has already suggested: for their habit is entirely Rubiaceous; and we frequently find in *Spermacoce* the same variation in the number of stamina and in the divisions of the corolla; and a somewhat similar involucrum may be observed in *Canephora*. The anomalous structure of their fruit is derived from the early rupture and confluence of the ovaria and calyces, which constitute the operculum. The seeds in *Opercularia* and *Pomax* are attached to the base of the receptacle, and not suspended from the top, as Gærtner has stated. From observing the various degrees of confluence in the fruit of certain *Rubiaceæ*, such, for example, as *Morinda* and *Sarcocephalus*, and even in some species of *Spermacoce*, the singularity of the fruit in *Opercularia* and *Pomax* is very much lessened; and we are led to anticipate a similar state of the ovaria, rather than to regard it as a remarkable anomaly.

DEUTZIA, *Thunb.*

Syst. Linn. DECANDRIA TETRAGYNIA.

Ord. Nat. PHILADELPHEÆ, *nobis.*

Calyx campanulatus, 5-dentatus: *dentibus* ovatis, acutis, erectis. *Petala* 5, laciniis calycinis alterna, sessilia, oblonga, obtusa, pube stellatâ tomentosa.

Stamina 10; alterna petalis opposita, breviora: *filamenta* linearia, complanata, apice cuneato-tridentata! *dentibus lateralibus* obtusis, obliquis; *intermedio* subulato, longiore, antherifero: *antheræ* subrotundæ, biloculares, loculis tumidis, longitudinaliter dehiscentibus. *Ovarium* tubo calycis adhærens, hinc infernum. *Styli* 4, longi complanati, glabri. *Stigmata* capitata, pruinosa. *Capsula* subrotunda, lignosa, 4-locularis, polysperma, apice quadrifariàm dehiscens: *loculis* stylo verticalibus. *Placentæ* 4, axi insertæ, sublunatæ. *Semina* nondùm vidi.

Arbuscula (Japonica) *erecta, ramosissima.* Rami *teretes, cortice spadiceo, dein deciduo induti.* Folia *opposita, petiolata, ovata, acuminata, serrata (serraturis setaceis) membranacea, nervosa, utrinque, sed præsertim subtùs, ramulisque pube stellata vestita, basi rotundata, sesquipollicaria:* nervis *alternis, obliquè transversis.* Petioli *teretiusculi, lineam longi.* Racemus *terminalis, multiflorus.* Pedicelli *brevissimi, oppositi,* 1 *v.* 3-*flori, pilosi.* Calyx *et* corolla *alba, pube stellata, siccitate fulvescente, copiose vestita.*

1. Deutzia scabra, *Thunb. Diss. Nov. Gen.* 1. p. 20. t. 1. *Fl. Jap.* p. 185, t. 24. *Willd. Sp. Pl.* 2. p. 730.

Hab. in montosis prope Nangasacki Japonensium. ♄ (v. s. sp. in Herb. Lamb.)

An examination of several specimens of this interesting, but hitherto obscure genus, has enabled me to determine its place in the natural system. Although I have not had an opportunity of examining the seeds, its affinity to *Philadelphus* is clearly established, from which it is principally distinguished by the reduced number of its stamina, and by the structure of its filaments. The pubescence in all the species of *Philadelphus*, which I have had an opportunity of inspecting, is uniformly simple; but in *Decumaria* it is starry; and the capsule of this genus is four-celled, and the styles and stigmata are united into one body.

VIVIANIA, *Cavan.*

MACRÆA, *Lindl.*

Syst. Linn. DECANDRIA TRIGYNIA.

Ord. Nat. CARYOPHYLLEÆ, *Juss.* Prope Molluginem.

The genus *Viviania* was first proposed by Cavanilles in the "Anales de Ciencias Naturales, tom. vii. p. 211. t. 49.," published at Madrid in 1804; and it is rather singular that no subsequent author has taken any notice of it. Its intimate affinity to *Mollugo* proves it to be a legitimate member of the *Caryophylleæ*. It is chiefly distinguished from *Mollugo*, by the presence of petals, and the greater confluence of the styles and divisions of the calyx. In the structure of the capsule and seeds both genera entirely correspond.

The *Viviania marifolia*, of which Cavanilles appears to have seen but an imperfect specimen, collected by Don Luis Née, near Acapulco, comes very near to Mr Lindley's *Macræa rosea*, but the calyx is exhibited, in the figure above mentioned, as pentaphyllous, which, however, is most probably an error.

I have nothing to add to the excellent description given by Mr Lindley of the genus, in Brande's "Journal of Science," vol. xxv. p. 104.

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Additions to some of the Author's former Communications to this Journal.

PALO DE VACA. No. 6. p. 336.

Having lately had an opportunity of examining a nut of this tree, collected in Caraccas by Mr Fanning, who has also brought a considerable number of young plants of it to England, I am now satisfied of its being really a species of *Brosimum*, as M. Kunth has already suspected. The name of *Brosimum Galactodendron* may well be applied to the species.

CICHORACEÆ. No. 12. p. 306.

In writing out the prefatory remarks to the memoir on the above family, I have inadvertently fallen into an error in stating the anthers of *Compositæ* to be unilocular, they being really bilocular, and each cell composed of two unequal valves, the innermost being the narrowest. The characters of *Troximon*, p. 309, are derived from *T. glaucus* and *cuspidatus* of Pursh; and I rather think that *T. dandelion* of Gærtner will prove to be a species of *Cynthia*, a genus sufficiently distinct from *Krigia*.

CALAMPELIS. No. 13. p. 89.

Stamina 4, didynama, fertilia; *quinti rudimento* brevissimo, obtuso, glabro, intra stamina superiora breviora: *filamenta* teretia, glabra, arcuata: *antheræ*, bilobæ, biloculares, introrsæ: *loculis* divergentibus, apice distinctis, disco

magno, carnoso, hippocrepico, papilloso-glanduloso impositis: *valvulis* margine inflexis, demùm solutis, interiore parùm breviore. *Stylus* fusiformis, glaber. *Stigma* obtusissimum, leviter bilobum: *lobis* margine revolutis, minutè papilloso-pruinosis. *Ovarium* placentis 2 parietalibus, magnis, carnosis, seminiferis, subinde intervallo distinctis, uniloculare.

The previous description having been taken from dried specimens, it will be found to contain some inaccuracies, which are now corrected, from an inspection of the living plant.

Description of an Economical Apparatus for Heating Apartments. By JOHN HART, Esq. Communicated by the Author.

In this climate, where we must frequently have recourse to artificial heat, in order to keep up a proper temperature in our buildings, no plan seems to answer so well, both for the purposes of ventilation and heat, as that of introducing a copious stream of moderately heated air, by means of a well constructed cockle, especially for heating large houses, churches, or other public buildings. But as a cockle is very expensive, and requires a considerable space for its erection, any plan of economizing either must be acceptable to your readers. With this view, therefore, I send for insertion in your Journal, the description of an apparatus of this kind I got erected last year, for heating the Library and Apparatus Rooms of the Andersonian University, the cost of which was only about one-fourth the price of a cockle of the same heating power.

The space in the ground-floor being rather narrow to contain a cockle of sufficient size, it occurred to me, that a few cast-iron pipes, built into a furnace (after the manner of retorts in the ovens of the gas-works), would answer the purpose of a cockle, by simply causing the external air to pass through the heated tubes. I accordingly procured six cast-iron pipes of seven inches diameter, and nine feet long (gas mains cast without sockets), and had them built up after the manner shewn in the Plate III.; by this arrangement, I obtained about eighty superficial feet of surface, exposed to the heat, or, heating surface, equal to a cockle of four feet cube.

Plate III. Fig. 1. Section of the building, shewing the pipes laid inclined, the lower ends projecting through the wall of the furnace into the aperture or tunnel which communicates with the external air, while the other end of the tubes reaches about a foot beyond the opposite end of the furnace, before it enters the heated air flue in the wall of the buildings. A spiral of sheet iron, supported on studs, is introduced into the centre of each tube to give the air a gyratory or sweeping motion, along the surface of the heated metal. The tubes are placed about one inch asunder, and a row of fire-tile is laid above them, leaving a space of nine inches at the end uncovered, as seen in Plate III. figs 2. and 3.; by this arrangement, the flame and heat gets completely round them, and is made to sweep along their surface, till it finds a passage through the openings left between the tubes and the side-walls up to the next tier: it then passes along them in the same manner, when it finds similar openings at their other extremities up into the vent. The furnace used for heating these tubes is of the same construction as those used by the potters, as it consumes the smoke; the space for the fuel is fourteen inches wide by twenty-four deep; and the arch or opening for the admission of the flame is six inches in height. To prevent smoking the house from carelessness, when kindling the fire, or adding fresh fuel, the mouth of this furnace is provided with a lid or cast-iron cover: The air, therefore, for supplying the fire, enters by a side tube left in the brick-work, the opening of which is below the level of the arch of the furnace, and the aperture for the admission of the air has a register to regulate the draught; the furnace likewise is provided with a door in front to withdraw the ashes. The flame, after passing through the arch, is made to turn upward, and spread itself upon the tubes by means of the dwarf wall A; and the tubes being placed about two feet above the opening for admitting the flame, they never become red-hot. The external air enters the passage B by a grate in the wall; from thence it passes through the heated tubes, where it is rarified; it then ascends the heated air-flue, and escapes by the registers into the different apartments. The combined area of the pipes contains about 230 superficial inches of free space for the passage of the air, while the heated air-flue is two superficial feet, or 288

inches, and the combined openings into the rooms nearly the same size; the air, therefore, is seldom above 100°, unless some of the registers are shut. A damper is likewise placed where it enters the vent, which is generally shut so soon as the fire goes out, to retain the heat.

If the damper is shut, the apparatus, after the fire is withdrawn, will still be found giving out an agreeable warmth for two days after; in this property it resembles the brick-stoves of Russia or Holland. The cockle I was inquiring after would have occupied a space of six feet cube for the brick-work alone, and was to have cost L. 40; whereas this apparatus was put up for the following sum:—

Six cast-iron Mains, - -	L. 7	10	0
Two Dampers, Door, and Cover for the Fire-place, - - -	1	0	0
Brick-work, - - -	2	0	0
	L. 10	10	0

Besides, serious accidents have several times occurred with the common cockle, from the brick-work giving way between the furnace and the air-flue, through which the flame or sparks found a passage into the buildings. It must be evident, however, on inspection, that no danger of this kind can arise from this arrangement, as the communication with the air-tunnel, or lower end of the pipes, passes outside of the wall of the furnace altogether, so that no fire or sparks can ever get into the tubes; and, as their other ends project a foot beyond the opposite wall before they enter the heated air-flue, no sparks or dust can enter by that end.

In constructing a stove of this kind, care must be taken that the brick-work rest on one end of the tubes only, as their alternate expansions and contractions would soon rend the building; the tubes, therefore, must be free at one of their extremities, and the joints simply pointed round. I am, &c.

JOHN HART.

MITCHELL-STREET, GLASGOW,
Nov. 30. 1829.

On the Anomalous Structure of the Leaf of Rosa berberifolia.

By Mr David Don, Librarian to the Linnean Society, Member of the Imperial Academy Naturæ Curiosorum, of the Royal Botanical Society of Ratisbon, and of the Wernerian Society of Edinburgh, &c. (Communicated by the Author.)

The ordinary leaf of *Rosa* is compound, being generally composed of an indefinite number of pairs of leaflets, terminating with an odd one; and the lowest pair, although present in the form of stipulæ, are considerably modified, being found to be more or less confluent with the general petiolus. This view of the origin of the stipulæ, in this genus, is clearly shewn by the ultimate leaves, or bracteæ, in which the various degrees of modification may be observed. The stipulæ of *Rosa* vary much in size; in some species they are large and foliaceous; in others, such as *Rosa Banksiæ*, *microcarpa*, and *sinica*, they are small, and so very fugaceous as to be only observed in the early stage of the leaf. As in other extensive genera having compound leaves, it might be expected that *Rosa* would also contain species, in which a reduction in the number of leaflets takes place. In *Rosa sinica* and *hystrix* the leaflets are only three; while in *Rosa berberifolia*, and in a second species, known only from a representation contained in a collection of Chinese drawings preserved in the library at the India House, the leaf is reduced to its simplest form. The compound nature of a leaf reduced to its simplest form is always indicated by the presence of an articulation. A casual inspection of the leaves of *Rosa berberifolia* would lead one to conclude that the *stipulæ* were entirely wanting; but a more attentive examination shews that these organs are also present in this plant, although under a very anomalous form. Immediately under the leaf we find a callosity forming a prominent ridge on the branch, attenuated towards the base, and terminated by two or three spines. This callosity evidently originates in the confluence of the stipulæ with the stem. The leaf itself, surrounded by the spines, is situated immediately on the summit of this callosity, to which it is articulated by its very short footstalk. The articulation is particularly distinct, and clearly proves the compound nature of the leaf in *Rosa berberifolia.* This opinion, respecting the change of the stipulæ in this plant, may appear parodoxical, but it is borne out by a comparison of the leaves of certain *Capparideæ*, where the stipulæ have also become changed into spines, and where they are also partially confluent with the stem. The coriaceous leaves of *Rosa berberifolia*, their spiral insertion, and the elongated, callous bases of the confluent stipulæ, would seem to be intended by Nature to protect the young and tender shoots of this plant from the powerful effects of a scorching sun in those arid and sandy plains of which it is a native. It would be well to ascertain with certainty, whether the inside of the tube of the calyx, or hollow receptacle, is really destitute of bristles, as I was led to conclude from an examination of a solitary flower. This circumstance, if really constant, would perhaps justify its separation from *Rosa*, as Mr Lindley has already proposed.

Comparative View of the Secondary Rocks in the Alps and the Çarpathians. By A. Boué, M.D. Member of the Wernerian Society, &c. &c.—Communicated by the Author.

Several new journeys and investigations induce me, as the result of these, to distinguish the northern Alpine calcareous chain into two great divisions or masses of limestone; the one, *the inferior* of a blackish or grey colour, resting upon, or uniting itself with, the red sandstone, the slate and the sparry iron-ore limestone, and, lastly, with talcose and micaceous rocks, sheltering the central crystalline Alpine chain; the other, *the superior*, generally greyish white, being near the tertiary plain, and covering the salt formation. Between these two limestone deposites, there are, besides the salt-clay, a large body of grey marly sandstone, marls, conglomerate, and a deposite of limestone, characterised by particular ammonites, madreporites, orthoceratites, nautilites, terebratulites, &c. The sandstone is, like the salt deposite, not found every where; and, frequently, its place is taken by a marly deposite, which is characterized by fucoides, ammonites, hamites, belemnites, encrinites, &c.

The *inferior limestone* chains contain fishes, and particular fucoides, (Seefeld); the *superior limestone* contains terebratulites, nautilites, echinites, belemnites, singular bodies like hippurites, ammonites, &c.; and the dolomitic and oolitic character is more frequent in the superior chain than in the other. All these five sub-divisions are united together by alternations at their line of junction, as is well exemplified in the section from Werfen to Reichenhall in Salzburg.

Parts of the red slate and sandstone formation, below the Alpine limestone, re-appear on the northern side of the inferior chain, as at St Agatha, on the lake of Hallstadt, in the Abtenau, where it contains ophite or diorite masses, with much gypsum, as in the Pyrenees. The age of this singular red sandstone deposite we shall not now attempt to fix; for, although it has many of the characters of the old red sandstone, yet many things are against this classification.

The Alpine limestone is probably Jurassic, and we may be able, by means of my extensive collection of fossils, to recognise in it even those sub-divisions called great Oolite, Corn-brash, Coral-rag, Oxford Clay, &c. Upon this Alpine limestone there is superimposed, partly in conformable, partly in an unconformable position, a most diversified deposite, which is to be observed near the Wand in Lower Austria, at Lunz, Hinter Laussa, Gams, Hieflau, Windish Gersten, on the lake of Gmund, in the basin-like valley of Gossau, in the valley of Abtenau, upon the northern part of the Untersberg near Reichenhall, and at Samtjoch, to the north of Unter Schwatz in the Tyrol. Geological maps, sections, and descriptions, will fully prove this fact. Here, for the present, we shall rest satisfied, by mentioning that the conglomerate, which often forms the base of this formation, is seen lying upon the limestone in all the upper parts of the valleys to the north of Gossau, Geschitt, and Buchberg, and Hillau; other parts of the deposite lie unconformably upon Alpine limestone in the Brill valley, near Gossau in Hinter Laussa, or come only in contact with great walls of Alpine limestone, as at Hennerkogl, an alpine region near the lake of Gossau. This formation is composed of conglomerate, marly sandstone, with impressions of leaves or culmites, marls, clays, and beds of hippurite and nummulite limestone; these latter, along with the conglomerate, occupying the undermost part, although not always present, as is the case with all the other members. Sometimes one member predominates, sometimes another, and even in some localities only one or two members are present. The fossils of this deposite abound particularly in certain beds of clay and marl; whole beds of a tornatella like fossil, characterise the deposite at the Wand in the Gossau, at Gams, at the Untersberg, and in the Tyrol. Amongst the hippurites, like the *long horns* of Provence, we find the spirulites of the lowest chalk of Rochefort, or smaller species of hippurites. The cyclolites are very common every where; it is the Cyclus hemisphericus so common in the chalk and greensand of the Perigord. The Gryphæa Columba of the greensand is found in it in the Gossau, and has been confounded by Mr Lill with the Gryphæa arcuata. The variety of madrepores, astroites, agaricia, fungites, &c., is very great every where; but what is most striking amongst these secondary fossils, to which must be added some species of great inocerames or mytilites, Ostrea vesicularis of the chalk, are found a great many bleached univalve and bivalve shells, like rostellaria, turitella, natica, ovula, trochus, pleurotoma, arca, cucullæa, lucina, nucula, pecten, corbula, solen, delphinula, lituolites, discorbites, &c., fossils of which the species are often tertiary; and, indeed, so tertiary, that conchologists, who have not been *in loco*, thought there must be two formations. This opinion, however, is erroneous, for the same bed, even the same hand-specimen, contains cyclolites, gryphites, inocerames, mixed with these tertiary fossils. To the list of secondary fossils I must add the Ananchites ovata, and belemnites, which I found at the foot of the Wand, in Austria.

After this detail, I leave to the geological public to judge of the discrepancy of opinion between myself and Messrs Murchison and Sedgwick, who, as I hear, taking only into consideration the tertiary fossils, have classified the deposite in which they are contained, with the tertiary class, and suppose that these fossils had already existed in the time of the greensand and chalk deposite. But, does not the greensand of England sometimes afford fossils also found in the tertiary soil? The most curious localities of this formation is where the sandstone, conglomerate, and marl only are present, as at Hinter

Laussa, where they are separated from the Alpine limestone by a true pisiform iron-ore. In other parts, as in the Abtenau, very small parts of this deposite, and often in highly inclined strata, cover the older limestone, and have always been classed with the older limestone. This cameleon-like formation appears to contain gypsum, as at Untersberg, and sometimes also beds of coal. I did not observe in it any fucoides, although other vegetable remains are frequently found in it. Coal is known, and even used, at the Wand, near Mayersdorf, near Grünbach, and in the Abtenau. A substance, resembling retinasphalt, is found in it at Mayersdorf, and in the Gossau. This formation is most widely extended in Switzerland and Savoy, as in the canton Appenzell, St Gallen, Glaris, Schwitz, Unterwald (valley of Sarnen), Lucern (Pilatus, Entlibuch), Bern (Ralliger, Stocke, chain of the Masen, &c.), Pays de Vaud (Diablerets), in the Faucigny on the hills between Cluse, Vallorsine, and Sallenche. In the two last countries it rises higher than elsewhere, and perhaps this intimates the sudden elevation of those chains. The same is the case with the rocks of Mount Perdu, in the Pyrenees; but there is in that chain, as in Savoy, and at Bex, the greensand and other accompanying rocks.

Along the whole northern foot of the Alpine limestone chain, there is a vast deposite of greyish marly sandstone, with beds of limestone and of marly clays; it is the well-known sandstone of the Appenine and great Carpathian chains, viz. that sandstone in which fucoides are so frequent, the sandstone which also belongs to the S.E. part of Europe and the Pyrenees. This formation lies, in some places, unconformably upon Alpine limestone, as perhaps at Gieshübel near Vienna, or it comes most abruptly, and in a highly-inclined position in contact with the Alpine limestone, as near Ipsitz in Austria, at St Lorenz near Mondsee; in other places it is united with the limestone, by alternation, as near to Waidhofen, and especially near Amergau in Bavaria, and between Baden and Heiligen Kreütz in Lower Austria. The junctions, however, are generally concealed, or occupied by valleys. This vast deposite, several thousand feet thick, contains, in the lower part, conglomerate, and sometimes considerable beds of coal, with impressions of cycadées and other vegetables, as at Ipsitz, Gersten, and in the Carpathians.

In the Carpathian chain, the undermost part of this vast deposite is marl and limestone; the middle part is very quartzy, and the uppermost part is characterised by a smaller or greater number of beds of a particular compact limestone, containing ammonites, belemnites, and encrinites. Instances of it are seen at St Veit near Vienna, and also between Trentschin, and Silein, and Arva in Hungary. It is identical with the ruiniform or landscape marble of Florence; and beautiful ruiniform varieties are met with both in the Carpathians and in the Alps (Klosternenberg, Sontagsberg.)

These contorted and curved strata, pass gradually into chloritic greensand rocks, so that both deposites are intimately united. This transition often takes place upon two sides, as in the section between Iablunka and Silein in the Carpathians, or between Teisendorf and Reichenhall in Bavaria, or on one side, as between Gmund and Trauenstein. In this last place, the greensand part is entangled between the greyish sandstone formation and the Alpine limestone of the Trauenstein, in the Geschlief, in such a way that one would be apt to say that the vertical strata of the Trauenstein cover the greensand; but an examination at once disproves such an opinion. Masses of serpentine are found in the greyish sandstone, in two points between Waidhofen and Ipsitz, as well as in Italy; and ophite or diorite form curious veins in the lowermost marly part of the Moravian district of Teschen and Paskaw, &c.

The classification of this sandstone has hitherto been attended with much difficulty; but no one could believe that, if the Alpine limestone belongs to the Jura limestone, this sandstone must belong to the greensand; for I found it lying upon newer parts of the Jura limestone, and containing diceratites, madrepores, &c., at Andryschow, in Gallicia; and this Jura limestone is the same that extends from Ernstbrunn, in Austria, to Nicolsburg, to Kurowitz, Stramberg, Stanislowitz, Podgoreze, and at last to the great Jura deposite of Russian Poland. The Jura limestone, a well characterized transition limestone, and the undermost part of our problematical sandstone, forms a great extent of country in Eastern Moravia, and Gallicia, marked on the maps as entirely transition limestone. Besides, Mr Lill is of opinion that our sandstone alternates with Jura limestone; that, at Koscielisko, where it lies, as in the Alps, conformably upon Alpine limestone, it contains nummulites, so that we are inclined to place it *under* the greensand, which, in fact, covers it in many places, and even under that other subdivision of the greensand deposite, which we described in the Alps, and which reappears with many of the same characters in the Carpathian chain. It would thus, then, probably prove to be contemporaneous with the uppermost divisions of the English Jura, viz. Purbeck limestone and Kimmeridge clay? and with those alternations of nummulite and compact limestone, with the sandstone containing fucoides, in Istria and Dalmatia. Whether I be right or wrong, the fact still remains of its lying upon alpine limestone, as well in the Alps as in the Carpathians; for the limestone of the Alps continues from Haimburg and Thelen, through Jablonitz, Neustadt, Trentschin, Silein, Bela, Tishora, to Koscielisko and Zakopane, in the Tatra, and terminates there to the eastward of this crystalline groupe. In the limestone chain of the Tatra, I observed the limestone lying upon the red sandstone, which is separated from the limestone by a breccia containing belemnites, terebratulites, &c.; the same subdivision into two limestones separated by a marly sandstone, containing fucoides; but the whole deposite is by no means so thick as in the Alps. Upon this limestone our problematical sandstone lies; and above its upper limestone beds there occur only the conglomerate, nummulite limestone, and a grey sandstone, without fucoides, which we saw in the Alps. The section from Koscielisko to Neumarkt is very excellent, every bed nearly is seen, and there is no derangement of the stratification; it is the equivalent, as M. Lill says, to that in the Alps between Werfen and Teisendorf, which is the best in the whole Alpine chain.

The Carpathian chain appears to be so constituted, that our greyish sandstone lies on the south side upon the Carpathian Jura limestone, our presumed Jura limestone; while, on the north side, it lies on the decided Jura limestone of Poland. In the middle the limestone forms basin-shaped cavities, filled up by rocks like those of Gossau, and the true chloritic greensand, followed by the lowermost hard chalk, or Planer limestone, with fishes, inocerames, &c. and vegetable remains. A great part of

Gallicia is occupied by a chalk-basin of this description, covered with tertiary rocks. The particular feature of this Carpathian and Alpine chalk, is its alternation with very sandy or marly greyish-sandstone, with fossil vegetables. In the Alps, fine masses of this kind occur in the greensand in the Allgau near Sonthofen, where it contains also in its undermost part not only nummulite limestone, but also, as at Neukirchen and Lauerz, iron-ore, with many fossils. Count Munster pronounces these last to be tertiary, an opinion which I cannot reconcile with the belemnites, inocerames, and ammonites, which I found in the under part of the greensand of Sonthofen.

Upon the chalk of Gallicia there rests a vast deposite of blue clay, with gypsum, salt, and sulphur. I found in the salt not only some subappenine shells, as Ostrea navicularis, taken for a Gryphæa acuta by M. Pusch, Pleurotoma, a Nucula, allied to the Margaritacea, microscopic shells, &c., but also fresh-water shells, as Anodontæ, Paludinæ and Mytili, like those of the Danube. These shells of Wieliezka probably occur in other salt-mines. At Lemberg I found, upon the chalk, the same marls, with rolled masses of the same Jura limestone and of granite as in the mine of Wieliezka. The Moldavian and Transylvanian salt deposite, with brown coal, must also be tertiary. Above this clay there is only a very thick deposite of sand and sandstone, which covers the foot of the Carpathians in Gallicia, as well as in Transylvania, but which, being the result of the decomposition of the Carpathian sandstone, occasionally assumes its appearance, and has till now been confounded with it.

The tertiary sandstone is characterized by its sands, its marls, its beds of semiopal, its tertiary shells (ostrea, pecten, nummulites), and its not containing fucoides. In the plain of Gallicia and Podolia, and in the Bukowina, the tertiary clay is covered by sand, sandy marl, with beds of a tertiary limestone, which is partly cellular, without shells, and has the appearance of a formation which has taken place in brackish water. Generally these beds are followed by others full of cerites, or miliolites, and also mixtures of fresh and salt water shells, resembling those in Austria and Hungary, and above there are vast deposites in the quartzy sand, of coral limestone, both compact and disintegrated. An old alluvial marl covers the whole near the great river. The coral limestone occupies the same position in Austria and Hungary as it does in Gallicia, and not under the clay, as every one, excepting M. Prevost, thought. New quarries have established this fact in a decisive manner. French geologists had already, through means of the fossils, come to the same conclusion, in regard to the coral limestone of Brittany and Manche, which is the calcaire moellon of Marcel de Serres. The under part of the blue clay at Lemberg, in Gallicia, abounds in amber. You already know that the chalk on the Dneister lies upon a reddish sandstone, united by alternations with a limestone containing trilobites, orthoceratites, spirifer, productus, bitibulites, or the spines of the Strophomene rugosa. M. Partsch observed in different places of Transylvania the same undermost greensand formation, with tornatillæ, cerithiæ, the Gryphæa columba, as in the Alps. The same deposite, with immensely thick beds containing Gryphæa columba, I observed, in company with Kefferstein and Lill, at Orlowa, in the N. W. Carpathian. The same, with beds of nummulite limestone, is met with in Bukowina and at Poyana Stampi.

Description of several New or Rare Plants which have lately flowered in the neighbourhood of Edinburgh, and chiefly in the Royal Botanic Garden. By Dr Graham, Professor of Botany in the University of Edinburgh.

10th Dec. 1829.

Begonia diversifolia.

B. *diversifolia;* herbacea, glaberrima; foliis radicalibus reniformibus late crenatis, caulinis sublobatis inæqualiter argute serratis, superioribus inæqualiter cordatis, inferioribus reniformibus; floribus axillaribus congestis, pedunculis petiolos æquantibus vel superantibus ramosis; capsulæ ala maxima acutangula.

Description.—Whole *plant* smooth and shining. *Stem* herbaceous, twining, branched, smooth, very obscurely angled, transparent. *Stem leaves* alternate, petioled, half cordate, acuminate, somewhat lobed towards the base, acutely and unequally serrated, smooth, bright green above, paler and somewhat glaucous behind; nerves branched and prominent behind: *petioles* shorter than the leaves, spreading, flattened on the upper side. *Root-leaves* kidney-shaped, nearly equal at the base, broadly crenate, on petioles many times longer than themselves, and which are slightly compressed at the sides, and channelled above: a few leaves at the bottom of the stem resemble these, but are on shorter petioles, and have their edges pretty equally lobed, the lobes being unequally and sharply serrated.

Stipulæ ovate, oblique, green, ciliated. *Peduncles* axillary, about as long as the petioles on the lower part of the stem, longer above; slightly compressed, bracteate, pedicels rising from the axils of the bracteæ, solitary, or two together, a male and female. Occasionally the peduncle is twice divided, with a pair of opposite bracteæ at each division; and it is extremely probable, that, at another season of the year, the inflorescence would look very differently, and the plant assume a much handsomer appearance, from perfecting many more flowers; for in the axil of the leaf from whence the peduncle springs, and in the bosom of each bractea, there is a cluster of flower-buds. *Bracteæ* cordato-ovate, concave, blunt, entire, shorter than the pedicels. *Corolla* rose-coloured; outer petals cordato-ovate, pointed, sharply serrated; inner petals obovato-elliptical, entire, subacute. *Stamens* yellow, monadelphous, union of the filaments extended high; anthers (as is common in the genus) obovate, truncated, compressed, the pollen-cases being distant, lateral, connate. Germen with three unequal sides, unequally winged, of three somewhat unequal loculaments, each containing a large, green, bi-parted, waved, seminal receptacle, covered with minute ovules; the largest wing acute, the second subacute, and the third very small and rounded.

As far as I can judge by the imperfect characters which have been publihed of this beautiful and extensive genus, this species is undescribed. It was raised from seeds sent from Rigla in Mexico to P. Neill, Esq. by Captain Vetch, and flowered in the stove at Canonmills in October 1829.

Gomphalobium polymorphum, var. luteum.

This variety was imported from New Holland by F. Henchman, Esq. and sent by Mr Mackay to the Royal Botanic Garden, where it flowered in spring last. It does not differ at all from the representation given of the species in Botanical Magazine, t. 1533, except that the leaves are more generally linear, and the flowers of a bright yellow, with a faint red tinge on the back of the vexillum.

Sphacele Lindleyi.

S. *Lindleyi;* ramis floccoso-tomentosis; foliis petiolatis, cordato-deltoideis, subtus albidis; bracteis sessilibus ovatis; verticillis sub-8-floris.

Sphacele Lindleyi, ramis floccoso-tomentosis, foliis petiolatis ovato-lanceolatis basi obtuse hastato-sagittatis subtus tomentosis superioribus sessilibus axillis utrinque sub-trifloris.—*Benth.* MS.

Sphacele Lindleyi, *Benth. in Bot. Reg.* fol. 1289.

Stachys salviæ, *Lindl. Bot. Reg.* t. 1226.

Description.—*Shrub* (in our specimens 5 feet high). *Stem* round below, bark brown, cracked, and peeling, younger shoots tetragonous, green, and pretty densely covered with short, white, soft tomentum. Wood hard, with a large pith. *Branches* decussating. *Leaves* on petioles about a third of their own length, spreading, cordato-deltoid, attenuated to a long bluntish apex, much wrinkled, light green, on both sides covered with a short soft tomentum most abundant and white below, middle rib strong, and, as well as the reticulated veins, very prominent below. *Bracteæ* sessile, ovate, acute, in structure and colour resembling the leaves. *Flowers* in verticels, generally of 8 flowers, spreading at right angles, peduncled: *peduncles* simple, filiform, purple. *Calyx* campanulate, scarcely bilabiate, green, with many (13–15, Benth.) purplish nerves, reticulated towards the teeth; tube twice as long as the peduncle, naked within; teeth 5, subulate, subequal, rather larger upwards, naked at their apices, giving to a point the appearance of a minute soft mucro, but every where else on its outside, as well as the peduncle and outside of the corolla, tomentous. *Corolla* bilabiate, purple, twice as long as the calyx; tube subcylindrical, slightly inflated towards the faux, white at its origin, and, where the colourless portion terminates, surrounded on its inner side with a dense ring of erect white hairs; upper lip suberect, notched; lower lip trifid, lobes rounded, nearly equal, reflexed, the middle one emarginate. *Stamens* 4, didynamous; filaments adhering to the inner side of the tube to near the faux, erect, straight, distant, nearly colourless; anthers dark, bilobular, lobes linear, subacute, spreading, and both turned outwards, forming nearly a right angle with each other; pollen white. *Stigmata* subequal, spreading. *Style* filiform, shorter than the stamens, purple above. *Germen* on a fleshy disk, 4-lobed, lobes obovate, green, smooth. Whole plant perfumed.

The genus *Sphacele* was instituted by Mr Bentham in his valuable review of the *Labiatæ*, now in the course of publication in the Botanical Register, and characterised in fol. 1289. of that work. The name is meant to express the resemblance to the Sage, which is indeed very great in the present species. Mr Bentham enumerates three species, which he finds in the herbarium of the Horticultural Society, all collected in Chili by Mr Macrae, collector to the Society; and the specific character which I have quoted from Mr Bentham, is contained in a letter to Dr Hooker, from which also I have extracted, with his permission, some part of the above description. Dr Hooker informs me that he also has three species in his herbarium; but he does not say whether they are the same as those mentioned by Mr Bentham.

This species was raised from seed sent to the Royal Botanic Garden, Edinburgh, by Mr Cruckshank in 1822, having been gathered by him in Chili, where only the genus has hitherto been found. It has been kept in the greenhouse, and flowered with us for the first time in November 1829. It has also flowered in the Botanic Garden, Glasgow, the seeds having been procured from the same valuable correspondent.

Lobelia mollis.

L. *mollis;* annua; caule erecto, ramoso-pubescente; foliis petiolatis, subcordato-ovatis, acutis, supra pubescentibus, subtus ad venas solummodo, mucronulato-duplicato-serratis, superioribus lanceolatis; bracteis pubescentibus; pedunculis terminalibus, elongatis, racemosis; pedicellis laxis; calyce inferiore, laciniis subulatis, corolla brevioribus.

DESCRIPTION.—Annual (1 foot high). *Stem* erect, branched, slightly flexuose, sparingly pubescent, purplish below, green above. *Branches* erect. *Leaves* (8 lines long, 6 broad) scattered, petioled, pale green, soft, ciliated, pubescent on the upper surface, but on the midrib and veins only below, subcordato-ovate, doubly incise-serrated, each vein terminated with a little dark mucro; the lower leaves less acute and more entire, the upper narrower and more lanceolate, those in the middle of the stem ovato-deltoid and pointed. *Petioles* half the length of the leaves, slightly winged and ciliated. *Peduncles* terminal, elongated (3½ inches below the lowest pedicel) nearly glabrous. *Pedicels* (6 lines long) filiform, slightly pubescent, rising from the axil of a subulate, pubescent *bractea*, which is less than a third of the length of the pedicel. *Calyx* of 5 subulate segments, inferior, subadpressed, green, glabrous, equal in length to the tube of the corolla, marcescent. *Corolla* (2½ lines long) inferior, glabrous, purplish, marcescent; limb 5 parted, two segments spreading, and turned up, linear-subulate, three straight parallel, projecting downwards and forwards, linear-lanceolate nearly equal to each other, concave, broader and paler than the ascending segments; tube cylindrical, cleft along its upper side, equal in length to the calyx. *Stamens* five; filaments pubescent, flat, colourless; anthers united, purplish, slightly hairy, with two short, white awns, projecting from their lower edge. *Pistil* equal in length to the stamens; germen superior, ovate, green, glabrous, grooved on two sides; style subclavate, smooth, colourless; stigma subsimple, pale leaden-coloured, bearded; ovules minute, numerous, attached to a central receptacle. *Seeds* small, ovate, brown.

Raised at the Botanic Garden from Dominica seeds sent by Dr Krous in the end of 1828, and flowered from September to November.

The species is very nearly related to *Lobelia Xalapensis*, Humboldt, Nov. Gen. Spec. Plant. v. iii. p. 246., but differs in the bracteæ and stem being pubescent, in the sharp teeth of its leaves, in the longer peduncles and pedicels, and in the calyx equalling the tube only, not the whole length of the corolla. If Sprengel is right (System. Veget. i. 713.) in considering *L. Xalapensis* perennial, then *L. mollis* further differs in being strictly annual; but if I have not forgotten, and I have not the volume by me at the moment, Humboldt makes no such statement.

Lobelia rugulosa.

L. rugulosa; foliis subrotundis, repandis, nervoso-rugulosis, glabris pedunculis folia longe superantibus; laciniis calycinis integerrimis, base glandulosis; caule maculato, prostrato, radicanti.

DESCRIPTION.—Whole *plant* glabrous, with milky juice. *Stem* procumbent, diffused, much branched, slightly flexuose, covered with oblong, dark olive-brown spots, obscurely channelled on two sides, one side of each shallow groove having a slightly prominent edge. *Leaves* (4 lines long, 3 broad) alternate, distichous, spreading at right angles to the stem, flat, petioled, veined, dark green and slightly wrinkled above from the elevated veins, paler below, edges slightly callous, repand, dentate. *Petioles* about a third of the length of the leaves. *Peduncles* (1¾ inch long) solitary, axillary, erect, filiform, reddish below, green above. *Calyx* persisting, superior, segments awl-shaped, nearly equal, somewhat spreading, quite entire, having along each edge at the base an oblong gland, which is in certain states green and indistinct, in others white and conspicuous. *Corolla* (8 lines across) white, marcescent, cleft nearly to the base along the upper side, segments five, somewhat unequal, spreading, slightly pointed, arranged like the radii of a semicircle, the middle segment rather the largest and most linear, the others narrower, more tapering at the base, and more deeply divided; at the faux, the four upper segments have in the middle a purple streak, the lowest segment, and the somewhat prominent edges of the others in contact with it, are at this point yellow. *Stamens* 5, equal to the length of the tube of the corolla; filaments free, curved, colourless; anthers united, curved, leaden-coloured, smooth, with two short awns projecting downwards from their apex; pollen white. *Stigma* large, glandular, bilobular, revolute, of a faint rose colour. *Style* green, bent at its apex. *Germen* green, obovate, slightly compressed laterally, oblique, slightly furrowed, bilocular, dissepiment in the shortest diameter with a seminal receptacle on each side. *Ovules* numerous, minute, colourless.

We received this plant, without any specific name, from Messrs Young, nurserymen, Epsom, in 1828. It is a native of New Zealand, and flowered very freely in the greenhouse of the Royal Botanic Garden in August and September. As far as I can judge by the description of *Lobelia membranacea*, in Prodr. Nov. Holland., it should stand next to that species of Mr Brown.

Celestial Phenomena from January 1. *to March* 1. 1830, *calculated for the Meridian of Edinburgh, Mean Time.* By Mr GEORGE INNES, Aberdeen.

The times are inserted according to the Civil reckoning, the day beginning at midnight. —The Conjunctions of the Moon with the Stars are given in *Right Ascension.*

JANUARY.

D.	H.	′	″		D.	H.	′	″	
2.	2	25	17	☽ First Quarter.	17.	4	0	57	☾ Last Quarter.
3.	1	46	50	☌ ☽ ρ ♓	17.	14	45	13	☌ ☽ κ ♍
4.	11	37	30	☌ ♂ κ ♎	19.	7	52	33	☌ ☽ γ ♎
5.	20	6	54	☌ ☽ γ ♉	20.	8	53	23	☌ ☽ ♂
5.	21	23	13	☌ ☽ 1 δ ♉	20.	9	57	27	☌ ☽ φ Oph.
5.	21	52	41	☌ ☽ 2 δ ♉	20.	11	38	37	☉ enters ♒
6.	2	52	44	☌ ☽ α ♉	20.	16	51	33	Em. III. sat. ♃
8.	15	35	8	☌ ♂ λ ♎	21.	1	27	16	☌ ♃ λ ♐
9.	3	26	37	○ Full Moon.	22.	11	3	36	☌ ☽ ♃
11.	7	56	2	☌ ☽ ♄	22.	13	2	13	☌ ♀ φ ♒
11.	12	49	35	☌ ☽ ξ ♌	24.	16	53	59	● New Moon.
13.	9	30	–	☌ ☿ ϑ ♑	24.	20	15	40	☌ ☽ ♅
13.	22	2	–	☌ ☿ ♅	26.	0	30	–	☌ ☽ ☿
13.	23	38	39	☌ ☽ σ ♌	26.	12	36	31	☌ ☽ ϑ ♒
14.	11	35	57	☌ ☽ β ♍	26.	18	50	–	☌ ☉ ♅
14.	13	29	16	☌ ♀ λ ♒	27.	.	. .	. .	☿ greatest elong.
15.	3	12	51	☌ ♂ η ♍	27.	19	51	20	☌ ☽ ♀
15.	10	35	20	☌ ♂ ν ♎	27.	20	50	43	Em. III. sat. ♃
16.	5	50	37	☌ ☽ ϑ ♍	31.	10	47	28	☽ First Quarter.

FEBRUARY.

D.	H.	′	″		D.	H.	′	″	
2.	1	44	49	☌ ☽ γ ♉	13.	22	30	13	☌ ☽ κ ♍
2.	3	2	22	☌ ☽ 1 δ ♉	15.	16	11	28	☌ ☽ γ ♎
2.	3	32	21	☌ ☽ 2 δ ♉	16.	0	29	26	☾ Last Quarter.
2.	8	37	54	☌ ☽ α ♉	16.	18	49	3	☌ ☽ φ Oph.
4.	0	40	–	☍ ☉ ♄	18.	5	49	18	Im. III. sat. ♃
7.	11	42	12	☌ ☽ ♄	18.	6	21	12	☌ ☽ ♂
7.	19	44	7	○ Full Moon.	19.	2	22	47	☉ enters ♓
7.	20	42	2	☌ ☽ ξ ♌	19.	9	41	44	☌ ☽ ♃
9.	0	39	18	☌ ♂ ϑ Oph.	20.	2	12	27	♃ very near 1 ν ♐
10.	8	25	1	☌ ☽ σ ♌	21.	9	27	44	☌ ☽ ♅
10.	13	25	6	☌ ♂ B Oph.	21.	20	42	–	☌ ☽ ☿
10.	19	18	22	☌ ☽ β ♍	22.	22	44	56	☌ ☽ β ♑
11.	10	52	56	☌ ☽ η ♍	23.	4	36	58	● New Moon.
11.	23	30	–	Inf. ☌ ☉ ☿	24.	11	31	6	☌ ☽ ♀
12.	13	27	16	☌ ☽ ϑ ♍					

MARCH.

D.	H.	′	″	
1.	7	24	12	☌ ☽ γ ♉
1.	8	40	45	☌ ☽ 1 δ ♉
1.	9	10	20	☌ ☽ 2 δ ♉
1.	14	12	10	☌ ☽ α ♉
1.	20	1	44	☽ First Quarter.
5.	5	30	50	Im. I. sat. ♃
5.	19	50	0	☌ ♃ ο ♐
6.	14	10	24	☌ ♃ ♄
7.	3	9	45	☌ ☽ ξ ♌
7.	15	40	–	Inf. ☌ ☉ ♀
9.	13	28	53	○ Full Moon.
9.	14	17	29	☌ ☽ τ ♌
10.	.	.	.	☿ greatest elong.
10.	2	12	17	☌ ☽ β ♍
10.	17	46	11	☌ ☽ η ♍
11.	5	22	44	☌ ☽ γ ♍
11.	20	19	27	☌ ☽ ϑ ♍
12.	18	40	32	☌ ♂ 1 ν ♐
13.	5	21	53	☌ ☽ κ ♍
14.	23	17	2	☌ ☽ γ ♎
16.	2	17	38	☌ ☽ φ Oph.
16.	10	12	17	☌ ☽ ο ♐
17.	17	31	58	☾ Last Quarter.
18.	4	11	0	☌ ♂ π ♐
19.	2	5	50	☌ ☽ ♂
19.	2	27	53	☌ ☽ ♃
19.	11	55	18	☌ ♂ ♃
20.	8	52	37	☌ ☽ β ♑
20.	22	2	33	☌ ☽ ♅
21.	2	26	55	☉ enters ♈
22.	9	46	55	☌ ☽ ϑ ♒
22.	20	57	–	☌ ☽ ☿
23.	0	30	55	☌ ☽ ♀
24.	14	37	0	● New Moon.
26.	4	42	20	Em. III. sat. ♃
28.	11	45	–	☌ ☿ φ ♒
28.	15	7	17	☌ ☽ γ ♉
28.	16	21	16	☌ ☽ 1 δ ♉
28.	16	49	52	☌ ☽ 2 δ ♉
28.	21	42	0	☌ ☽ α ♉
31.	6	49	24	☽ First Quarter.

Times of the Planets passing the Meridian.

JANUARY.

D.	Mercury. H.	′	Venus. H.	′	Mars. H.	′	Jupiter. H.	′	Saturn. H.	′	Georgian. H.	′
1	12	24	15	19	8	42	11	17	2	40	13	47
5	12	37	15	17	8	37	11	5	2	23	13	33
10	12	53	15	14	8	32	10	49	2	2	13	14
15	13	8	15	9	8	26	10	35	1	41	12	56
20	13	19	15	1	8	19	10	19	1	19	12	36
25	13	26	14	54	8	13	10	5	0	59	12	18

FEBRUARY.

D.	Mercury. H.	′	Venus. H.	′	Mars. H.	′	Jupiter. H.	′	Saturn. H.	′	Georgian. H.	′
1	13	17	14	38	8	5	9	44	0	28	11	53
5	12	58	14	26	8	1	9	32	0	11	11	37
10	12	22	14	10	7	56	9	17	23	47	11	20
15	11	41	13	49	7	50	9	1	23	25	11	0
20	11	7	13	27	7	45	8	47	23	4	10	42
25	10	44	12	59	7	40	8	21	22	42	10	23

MARCH.

D.	Mercury. H.	′	Venus. H.	′	Mars. H.	′	Jupiter. H.	′	Saturn. H.	′	Georgian. H.	′
1	10	34	12	36	7	37	8	17	22	26	10	10
5	10	29	12	7	7	32	8	4	22	9	9	55
10	10	29	11	40	7	27	7	48	21	48	9	36
15	10	28	11	11	7	21	7	30	21	27	9	17
20	10	36	10	45	7	17	7	14	21	7	8	58
25	10	43	10	23	7	11	6	57	20	46	8	39

On the 6th of January there will be an occultation of *Aldebaran* by the Moon.

	H. ′ ″	
Immersion, ... , .	3 26 40,	at 157°
Emersion, ...	4 14 53,	at 281°

The angles are reckoned from the Moon's vertex, towards the right hand, round the circumference, as viewed in an inverting telescope.

Proceedings of the Wernerian Natural History Society.

1829, *Dec.* 5.—Dr WALTER ADAM, V. P. in the Chair.—Mr Witham of Lartington read an interesting paper on the Vegetation of the first period of the ancient World, and illustrated it by sketches, and by the exhibition of a number of fine specimens of stigmariæ and sigillariæ, chiefly from the coal-field of Newcastle. In the course of his observations, he likewise gave an account of the very remarkable stem of a monocotyledonous plant found in Craigleith Quarry three years ago. (See p. 195.)—Dr John Gillies then read an account of the extensive Roads or Highways of the ancient Peruvians, still known by the name of Caminos del Inga. (The Doctor's paper is printed in the present Number of this Journal, pp. 53–58.)—The Rev. Dr Scot then read an essay on the Okrub of the ancient Hebrews, or Scorpion of the English Bible.

At this meeting, the following gentlemen were elected OFFICE-BEARERS of the Society for 1830:

ROBERT JAMESON, Esq. *President.*

VICE-PRESIDENTS.

Henry Witham, Esq.	Dr R. K. Greville.
Dr Walter Adam.	David Falconar, Esq.
Secretary, P. Neill, Esq.	*Librarian*, James Wilson, Esq.
Treasurer, A. G. Ellis, Esq.	*Painter*, P. Syme, Esq.

COUNCIL.

Dr John Boggie.	Sir Arthur Nicholson, Bart.
Rev. Dr Brunton.	Dr John Gillies.
John Stark, Esq.	Rev. Dr David Scot.
Dr John Aitken.	Dr Charles Anderson.

SCIENTIFIC INTELLIGENCE.

METEOROLOGY.

1. *Extreme dryness of the atmosphere of Greece, and rising of the land there.*—In a letter from Bory St Vincent, at present in Greece, to Geoffroy St Hilaire, dated Milo, 20th September, there are curious details in regard to the extreme dryness that prevails in the isles of the Archipelago during the summer. The dryness is such, that, under the influence of a temperature of 86° Fahr., nearly the whole animals and vegetables of the country disappear. The plains of France, he says, are less naked, and more abundant in animals, in the month of January, than are these islands in the months of summer. The only living creatures observed during the warm season are a few lizards running about the dry stone-walls. The coasts of the islands are not less meagre of living beings than the land; there are but three species of fucus, and six confervæ, and consequently no fishes. M. Bory St Vincent has particularly examined Santorini, the most curious island in the Mediterranean. It is throughout of volcanic formation. He is of opinion that new volcanoes will soon appear there. He visited a road-stead where the bottom is *rising* from year to year, and at present is not more than three fathoms from the surface of the sea, and is sensibly warm. Every thing announces that it will soon appear above the surface.

2. *Winter climate of Rome very favourable for consumptive persons.*—Carus, in his lately published Analekten, agrees with Dr Clarke in thinking that the beautiful and mild winter of Rome is very beneficial to consumptive patients, and adds, that this opinion is further strengthened by an appeal to the powerful and handsome form of the Romans, particularly the Roman females. In summer, Rome is exceedingly unpleasant and unhealthy. In proof of this it may be mentioned that the fever Hospital of St Carlo, during the winter season, is nearly empty, while in summer it generally contains 1000 fever patients,

brought from the unhealthy parts of Rome, and the Campagna di Roma.

3. *Climate of the Southern Hemisphere.*—A letter from an officer of His Majesty's Ship, Chanticleer, says, "The cold of southern regions is a complete fable, and at variance with truth and nature. At Cape Horn, in latitude 56° deg. south, vegetation was in full vigour in May, or the November of their year, and snow rarely lies upon the low grounds. In fact, we have sufficient matter to elucidate the climate of the south, and to establish its comparative mildness with the north, especially if America be taken as the example. The summers of the south are by no means warm or hot, nor the winters cold; but to compensate for this, it is the region of wind, storms, and rain; perpetual gales, and eternal rains: never twenty-four hours without rain." Another account from the same quarter says, Staten Land or Island is composed of steep mountains, 2000 feet high, covered to their summits with trees. The soil, at the foot of the mountains, is singularly marshy. The mean temperature of the island is constantly low, and varies but little; there is not more than a difference of four or five degrees of Fahr. during the twenty-four hours. The summers are not warm, the winters not cold; but as a compensation it seems to be the region of winds and tempests: not a day passes without rain, and the gusts of wind are almost perpetual. The barometer is almost always low; the magnetic intensity is feeble; electrical phenomena are of rare occurrence; and the winds are generally westerly.

4. *Dr Gerard's Travels in Thibet.*—Dr Gerard, the brother of Col. Gerard, who has traversed the Himalaya mountains, has just visited the valley of Sutlej, and made some curious observations at that place, which is the highest inhabited spot on the globe. The principal object of his journey was the introduction of vaccination into Thibet; but it appears that the prejudices of the Rajah prevented him from succeeding in that humane enterprise. One of the villages where he stopped was proved to be 14,700 feet above the level of the sea. At this place, in the month of October, the thermometer in the morning marked

16° Fahrenheit, and, during the day, the rays of the sun were so hot as to be inconvenient, and yet the waters in the lakes and rivers were frozen during the night, but were free from ice at two o'clock in the afternoon. By means of artificial irrigation, and the action of solar heat, large quantities of rye were raised at this immense height, some of the fields being at 14,900 feet. Dr Gerard gives his opinion, that cultivation might be carried as high as from 16,000 to 17,000 feet. The goats bred in this region are the finest in the country, and are of that species whose wool is used for the manufacture of shawls. At a height of 15,500 feet, quantities of fossil shells are found on calcareous rocks, upon strata of granite and pulverised schist: they consist of mussels, and others of various forms and dimensions. To the north of the frontier of Kinnaour, Dr Gerard attained a height of more than 20,000 feet, without crossing the perpetual snow. At one o'clock in the afternoon, the thermometer was at 27° of Fahrenheit. Notwithstanding this extreme elevation, the action of the sun had an unpleasant effect, though in the shade the air was freezing. The aspect of the surrounding regions was sublime and terrible; and, on the frontier, a ridge of snow was perceptible. In these regions, which for a long time were inaccessible, Mr Gerard met with one of the most intrepid philologists known in Hungary, named Cosma de Kords. This traveller, after advancing towards the centre of Asia, arrived at Kinnaour, in Thibet, where he fixed himself in the monastery of Kanum, and lived among the monks of the Lamaic religion. Aided by a learned Lama, he made great progress in the study of the literature of Thibet, and discovered an encyclopaedia in forty-four volumes, which treated of the arts and sciences. The medical part of this large work forms five volumes. The art of lithography has been practised at the principal city of Thibet from time immemorial, and it has been used to display the anatomy of the different parts of the human body. It appears that science and letters, flying from the tyranny of the caste of the Brahmins, abandoned the plains of Hindostan, and took refuge on the mountains of Thibet, where, until the present time, they remained totally unknown to the rest of the world.

HYDROGRAPHY.

5. *Ice-Islands off the Cape of Good Hope.*—A remarkable debacle has taken place this year among the Antarctic ices. About the end of April last, our ships met enormous floating masses of ice, about a hundred leagues from the Cape of Good Hope. The ship Farquharson being in south latitude 39° 45′, and 48° 46′ long., saw two ice-islands about 150 feet high, and about two miles in circumference. Their sides were deeply cut by fissures, in which the ice in some places resembled refined sugar, in others was not unlike limestone. These islands were surrounded with fields of ice, which appeared to have been broken from these islands.

6. *Colour of Rivers.*—The Rhine in its course from the Alps to the Lake Constance is *bluish*; after its passage through the green waters of the Lake Constance it is *grass-green*; and after repeated mixture with the rivers and streams of the Vorschweitz, Alsace, and the Black Forest, *yellowish green.* The Main, flowing from the ferruginous rocks and plains of Franconia, acquires a *reddish yellow* colour; during great degrees of cold, it becomes *greenish blue,* owing to the deposition of the iron ochre; and when if it is not coloured yellow, by long continued rains, it flows onwards with an *amber grey* colour. All the rivers, of Old Bavaria, which are formed of waters from lakes and alpine streams on the Iller, Lech, Iser, and the Inn, are *bluish green* in winter; in spring *grass-green,* and in autumn pale *herb-green.*

MINERALOGY.

7. *Impressions of Gems, &c. in Siliceous Sinter.*—At the hot springs of S. Filippo behind Radicofani, on the borders of the Papal States, siliceous sinter is daily depositing in considerable quantities. Impressions of gems and coins in this siliceous mineral, can be obtained in no great length of time, by exposing them to the spray of these springs.

8. *Notice of Magnificent Rock-Crystals, and rose-coloured Fluor Spar.*—About 100 years ago, a great drusy cavity, lined

with rock-crystals, was opened in Zinken, which afforded 1000 cwt. of rock-crystal, and at that early period produced 30,000 dollars. One crystal in this magnificent cavity weighed 800 cwt., others from 400 cwt. to 500 cwt. Within these few years, another opening has been made in the rock under the old drusy cavity. Last year the work was resumed in August, in those places where the snow could be removed. The work is now 34 feet advanced. In the course of working, very precious and beautiful rose-red octahedral crystals of fluor-spar were found in a cavity. The larger crystals were from one to two inches in diameter, and infinitely more beautiful than the rose-fluor of St Gothard.

9. *Magnificent rose-red Fluor-Spar.*—Lardy, in a letter to Leonhard, says, that he saw on St Gothard the famous specimen of fluor-spar mentioned by travellers, for which the proprietor asks 50 louis d'ors. It is an octahedron, with a rich rose-red colour, is four inches in diameter, and is formed of an aggregate of small octahedrons, or, more correctly, of tetrahedrons. He was shewn at the same place a six-sided prism of corundum, distinctly acuminated on the extremities, four inches long, and one inch broad. It rests on dolomite. It was offered for 15 louis d'ors. In the letter, Lardy mentions that the next meeting of the Swiss naturalists is to take place on Mount St Bernard.

10. *Price of Selenium.*—Selenium is now obtained in such quantity from the seleniferous lead-glance, that it may be purchased perfectly pure, at Harzgerode, at the rate of four louis d'ors the ounce.

GEOLOGY.

11. *Observations made on Mount Caucasus, by M. Kupfer.*—M. Gay-Lussac communicated to the Academy of Sciences a letter from M. Kupfer, Professor at Casan, dated from the Baths of the Caucasus, and containing various physical observations made on that mountain. M. Kupfer had with him an escort of 600 Russians and 350 Cossacks, which had been judged indispensable for his safety in these wild countries. He has succeeded, after much labour, in ascending one of the highest peaks of the Caucasus, which is said to exceed Mont

Blanc in height by 1000 feet. These observations agree with those which M. Gay-Lussac made at the same time. The Professor of Casan thinks he may conclude from them, that it is impossible to attribute the magnetic virtue of the globe to the existence of a central metallic nucleus.

12. *Gigantic fossil Plant of Craigleith Quarry.*—About three years ago, the workmen in this celebrated sandstone quarry (from which has been derived nearly all the beautiful freestone with which the New Town of Edinburgh is built) came accidentally to uncover what seemed to have been the trunk of a lofty tree. It now lay in a position nearly horizontal, and conformable to the dip of the sandstone strata. The colour and consistence of the trunk, or *cast* resembling a trunk, differed considerably from that of the sandstone in which it was imbedded, and the quarriers easily traced the stem for the length of thirty-six feet. At the base it was about nine feet in circumference; and it continued proportionally thick throughout, only declining slightly in size toward the upper end. It seemed to have been a single, unbranched stem; at least no certain symptom of ramification appeared. The internal structure seemed to be uniform, or without any visible distinction of bark, wood, and pith, or any trace of concentric layers. This singular specimen may therefore be regarded as a gigantic member of the Cyperaceæ, or of some other family of the Monocotyledonous tribe, belonging to the earliest Flora of our world. The greater part of this curious specimen was preserved for Mr Ramsay of Barnton, the proprietor of the quarry; but some fragments were left, and these, fortunately, fell into the hands of the active and ingenious Mr Witham of Lartington. That gentleman had thin sections cut, both transverse and longitudinal; and when these are placed under the microscope, the structure of a monocotyledonous plant is distinctly shewn. Mr Witham sent a fragment to M. Auguste Brongniart, who has made such vegetable remains his peculiar study; and he also pronounced the plant to have been monocotyledonous. At Mr Witham's request, likewise, the substance of the stem was submitted to analysis by Mr William Nicol; and 100 parts gave

Carbonate of Lime,	60
Oxide of Iron,	18
Alumina,	10
Carbonaceous matter,	9
Loss,	3
	100

Lime was, therefore, nearly as abundant in the fossil as silica in the containing sandstone rock.

13. *On Tertiary deposites.*—Marcel de Serres, in his interesting work on the Tertiary Deposites of the South of France, maintains, that, in that quarter, the coarse marine limestone *(Calcaire grossier)* and plastic clay abound. This, however, is denied by Cordier, Rozet, and Boué, who are of opinion, that these rocks are entirely awanting there, for there we have the Mediterranean basin, in which all the tertiary rocks are newer than the coarse marine limestone, and commence with the blue clay. The great basins of Wallachia, Bessarabia, Gallicia, Hungary, Austria, Bavaria, and Switzerland, belong to this system. Indeed, Dr Boué remarks, in a letter to Professor Jameson, "that the plastic clay, and coarse marine limestone of Paris, exist only at Paris, and, perhaps, also in England, and at a few points in Northern Germany, at Cassel, Helmstadt, Evessen, &c. Elsewhere no such formations exist, for all the lignite, or brown-coal deposites, in other countries, occur in the upper tertiary formations; and all which Brongniart and others have classified as coarse marine limestone in various parts of Europe belong decidedly to the same upper tertiary formation, which is Boué's second tertiary limestone, or the calcaire moellon of Marcel des Serres. The coral-limestone of the tertiary basins of Austria, Hungary, and Gallicia, according to new observations, lies, not below, but *above* the blue sub-Appennine clay. This deposite occurs in the same situation in the Manche, Tourraine, and Lower Brittany; and the coral limestone of Vienna, according to C. Prevost, takes the same position in the tertiary series."

14. *Chalk in the United States.*—Dr Morton of Philadelphia has transmitted to Paris a Memoir on the Chalk and Green-sand he has discovered in the United States. It will appear in the Annales des Sciences Naturelles of Brongniart.

15. *Number of Species of Fossil Shells in the Paris Basin.*—M. Deshayes, in a note to the French Academy of Sciences, intimates, that the total number of species of fossil shells in the Paris Basin determined until this time is 1200.

16. *More Caves containing Bones of extinct Animals mixed with works of art.*—M. Marcel des Serres has discovered several new caves, containing bones of extinct animals buried along with works of art. These caves, few in number, occur in the south-west of the department of Herault, at a short distance from the town of Bize. The bones, which are very numerous, belong chiefly to the *Ursus spelæus* and *Ursus arctoideus.* The works of art found along with these are fragments of very coarse and imperfectly made pottery. All these bones and fragments of pottery, irregularly mixed together, are contained in a red mud, which also incloses small rolled fragments of rocks, of various kinds. This mud is analogous to that which occurs in other caves in different parts of Europe, and which contains only the remains of extinct animals. Dr Boué, we observe, has just read a communication on this subject to the French Academy. In 1823 he found at Lahr, in what he considers marly diluvium, human bones. Cuvier, to whom these remains were shewn, agreed that they were human, but conjectured they might have been from some very ancient burying-ground. During the present year, our active friend has again visited this place, which is on the Rhine, and is more convinced than ever that they are of equal antiquity with the remains of antediluvian animals found in the same beds of marly diluvium,—while others contend, from the marl occurring on the banks of a river, that it may be of comparatively recent origin. As the subject will now undergo a thorough examination, it may be worth while to mention, that Schlotheim, Donati, Germar, Razoumouski, and Guittard, in their writings, mention their having found human bones along with remains of antediluvian animals. Cordier, we are informed, will soon publish a memoir on this curious subject.

17. *Natural History Society of Switzerland.*—The first volume of the Memoirs of the Natural History Society of Switzerland is about to leave the press. It contains two very interesting memoirs on the Jura by Merian and Rengger, one by Lusser

on the Urner Mountains, and also a description of the Bones of Kupfnach, by Schinz.

18. *Bones of the Palæotherium in Molasse.*—The sandstone of Ballingen, on the upper Zurich Lake, contains bones and teeth of the Palæotherium. This sandstone, which is tertiary, and a variety of the molasse formation, was formerly referred to the secondary class.

19. *Geognostical situation of the great deposite of Lead-glance and Calamine in Silesia.*—It is now perfectly ascertained, that this extensive deposite occurs in a variety of the *shell limestone*, particularly abundant in fossil shells. Lead-glance also occurs in the shell-limestone of Wurtemberg and Westphalia, and calamine in the same formation, in the Nekar circle in Baden.

BOTANY.

20. *Oak-Trees liable to be struck by Lightning.*—In Denmark, where there are considerable tracts covered with oak and beech trees, it is remarked, that the oaks are struck with lightning twenty times for once the beeches are struck. It is conjectured by some observers, that this circumstance is to be traced to the forms of the two species of trees.

21. *Potato at a great height on the Mountain Orizaba.*—MM. Schiede and Deppe, in a letter to Baron A. Humboldt, giving an account of their ascent of the great volcano of Orizaba in Mexico, mention that they found the potato in a wild state, at a height of 10,000 feet above the level of the sea. It was about 3½ inches high, with large blue flowers, and tubers or potatoes the size of a hazel-nut.

22. *Method of detecting the adulteration of Tea.*—The Chinese frequently mix the leaves of other shrubs with those of the tea-plant; this fraud is easily discovered by adding to an infusion of it a grain and a half of sulphate of iron. If it is true *green tea*, the solution placed between the eye and the light assumes a pale bluish tint; if it is *bohea tea*, the solution is blue, inclining to black, but if it is adulterated, it shews all the colours, yellow, green, and black.—*Desmarest's Chemie Recreative.*

23. *Culture of the Vine at Mexico.*—The Botanic Garden of Geneva possesses a collection of more than 600 varieties of

vines, collected from different vineyards in France, Switzerland, and Italy. In the month of November 1827, a selection of the best varieties was sent to Mr L. Alaman, one of the principal proprietors in the Mexican United States. He planted them on his lands in the state of Guanaxuato, and writes that a hundred and five stocks are in full vegetation. He adds, that, on the elevated plain of Mexico, the same inconvenience is not experienced in the cultivation of the vine which arrests its cultivation at Cayenne, and in several parts of the United States: namely, that the grapes of the same cluster ripen unequally. At Mexico, they ripen together as in Europe, and it is to be presumed, that this cultivation, which was formerly prohibited by the Spanish Government, might be established there, the climate resembling that of Murcia or Rome. If these hopes are realized, it will be curious that the Botanic Garden of Geneva should have been the means of furnishing these plants to South America. It will be recollected that it was the Paris garden that supplied Martinique with the coffee plants, from which originated all the coffee plantations in America; and that, in our own days, it has sent the bread-fruit tree to Cayenne, where it is now extensively cultivated. Facts like these, evidently demonstrate the practical utility of these establishments, which are commonly looked upon as exclusively subservient to theoretical studies.

ZOOLOGY.

24. *Periodical appearance of shoals of Herrings, in Loch Roag.*—Loch Roag, in the Western Islands, is one of the largest arms of the sea called *lochs*. Its jaws are about 6 miles wide, and it runs up through the island of Lewis for about 12 miles. The shores of the loch, following its windings, would measure not less than 40 miles. In westerly gales, the Atlantic swell rushes into it with great fury; but there are many little islands in it, which afford shelter to shipping, so that the loch abounds with places of safe anchorage. The finest and purest kelp used to be manufactured on the rocky shores of this loch, as evinced by its fetching at Newcastle generally a guinea per ton more than the kelp of any other Highland district. Before the middle of the 18th century, Loch Roag was the most celebrated herring-fishery station on the north-west coast

of Scotland; the Loch Roag herrings being accounted the largest and richest of all. Swedish vessels used to rendezvous in the loch, and buy up the herrings at 1s. a crane, *i. e.* a barrel of green fish as taken out of the net. Soon after 1750, the herrings abandoned Loch Roag, and for five and thirty years none were seen in it. About 1790, the shoals began again to revisit the loch; and for several years after that date very large and fine herrings were taken in it, during the months of November, December and January. In the course of the season of 1794, no fewer than 90 sail of decked vessels entered the loch, and the whole herrings captured, were bought up from the country fishers at the high rate of about half-a-guinea a crane. (Statistical Account of Scotland, vol. xix. p. 252). About 1797 the herrings once more bade adieu to Loch Roag, and no shoal has entered its precincts till the present autumn, when, after the lapse of 32 years, their presence was again witnessed, to the great joy of the parishioners of Uig. Mr Alexander Campbell, light-house keeper at Isle of Glass, writes to Mr Stevenson, civil engineer, on 31st October 1829, " There is this season a tolerably good fishing of herrings and cod on the east and west coast of Long Island: even in Loch Roag a quantity have been caught, where there have been no herrings for these thirty years past. At that time back, this loch was the first in the Highlands for herrings of a large size."

25. *Notice of the Comparative Anatomist, Bojanus.*—This unfortunate man was not only one of the most skilful anatomists of our time, as is shewn by his great work on the Anatomy of the Tortoise—a work which has never been surpassed,—but was also deeply versed in the philosophy of this important department of natural history. He died at Darmstadt, in the month of April 1827, in the vigour of life, at the age of fifty-one. His beloved wife, who watched and tended him with measureless affection, was separated from him by a sudden death, an event which hastened his dissolution. His last hours were soothed by the devoted kindness of his sister. He suffered under a fistula of the back, which penetrated to his lungs, and the bones also were probably corroded. He could stand, but with the greatest difficulty—he could not sit erect—and was almost

deprived of the use of his limbs; and yet, in defiance of mental agony and bodily pain, he continued, and apparently with undiminished vigour, his philosophic labours. The frightful disease he laboured under was caught at Wilna, in one of those dismal, cold, and damp apartments so often used for anatomical purposes. No biography of this remarkable man, as far as we know, has hitherto appeared. He was born at Buchsweiller, in Alsace, at that time belonging to Hesse Darmstadt. During the revolution he emigrated with his father, an officer in the Hessian service, to Darmstadt,—studied at Jena, and afterwards was appointed Professor of Veterinary Medicine in the University of Wilna, of which, for twenty years, he was a principal ornament. In the year 1818 he returned to Germany, on a visit to his relations and friends at Jena, Weimar, and Darmstadt, with the title of University Counsellor, and Knight of the order of Wladmir. On his return, he took with him, from Jena, an engraver, Lehman, to engrave the plates from his own drawings, for his great work, De Anatomia Test. Europ. Fol. for in Wilna there were no engravers, and the engraved plates had to be sent to Petersburgh to be cast off. These inconveniences occasioned an expence of many thousand dollars, for which he received no return, as in the year 1825, fifty copies only of the work had sold. Six copies were sent to Britain; and of these, one copy reached Edinburgh.

26. *Royal Medal presented to Mr Charles Bell.*—Our distinguished countryman Charles Bell, whose very important and beautiful discoveries in regard to the nervous system have raised him to the highest rank as an original and profound anatomist and physiologist, has just received from the Royal Society of London the first royal medal, as a testimony of the important services he has rendered to science by his discoveries.

27. *Anatomical, Physiological, and Pathological Researches, in regard to Veins.*—M. Dupuytren has just made a very favourable report to the French Institute, in regard to M. Breschet's work on the veins of the bones. The veins of bones were entirely unknown about twenty years ago; at least they were only admitted as a necessary consequence of the laws of organization, for no facts or researches had then proved their existence. It was

about this time that MM. Fleury and Chaussier, and Breschet, discovered the veins of bones. For the first time veins were seen penetrating the diploe, under the form of canals, with osseous walls, equally incapable of dilatation, contraction, or change of place. It was discovered that the blood could circulate in these canals, without the aid of the action of their sides, but solely by the impulsion of the arterial blood into that of the veins, or by a kind of inherent power of absorption of this latter order of vessels. The veins of the flat bones of the cranium, of the shoulders, and of the pelvis, those of the ends of the principal long bones, were alone only known at that time, so that much remained to be discovered. Such was the state of the subject when Breschet resumed researches which had been abandoned for a long time. Breschet has confirmed all previous observations, and traced veins through all the other bones in which they had not been detected. His investigations have made us almost as completely acquainted with the veins of the bones as we are with the arteries of the bones. But Breschet has not confined his researches to the veins of the bones; he has extended them to the veins which serve to co-ordinate the first to the general venous system. Here we place his researches into the veins of the interior surface of the brain, of the surface and interior of the rachis,—labours which alone would have conferred high distinction on many anatomists. Such is a general statement of the facts and discoveries which form the basis of this very original work, now in the progress of publication.

28. *Cross of the Anas clangula and Mergus albellus.*—Inspector Eimbeck of Brunswick exhibited, at the meeting of naturalists in Berlin, a bird, which appears intermediate between the *Anas clangula* and *Mergus albellus.* Some of the naturalists present were disposed to consider it a cross of the two species —others to view it as a distinct species. It was shot in the summer of 1828, near to Brunswick.

29. *Remarkable Birth.*—A few days ago, a poor man's wife at Rowdle was confined, and attended by Dr Clark. She had three children: the first natural; the second had four hands and four feet. The woman and infants are all dead. The third died before the birth.—Extracted from letter from Alexander

Campbell, light-house-keeper at Isle of Glass, to Mr Stevenson, engineer for Northern Lights.—*31st October* 1829.

30. *Thompson's Zoological Illustrations.*—The third number of Dr Thompson's "Zoological Illustrations and Researches" is nearly ready for publication. It contains a memoir on the Cirripedes or Barnacles, shewing their deceptive character, the remarkable metamorphoses they undergo, and proving that they belong to the class *Crustacea*. The same number also contains observations on the genus Nebalia of the class Crustacea, with an illustrative plate. In volume 6th of the new series of this Journal, at page 398, we noticed from the Zoological Journal, the discovery in the Caribbæan Seas, by Mr Landsdoun Guilding, of a new species of recent Encrinus. Mr Thompson, in the present number of his Illustrations, however, as we are informed, has proved it to be a Comatula, and maintains that no crinoidal animal has been found since he discovered the Pentacrinus europæus. We may add, that Heusinger, who is about to publish his observations on the Comatulæ of the Mediterranean, is disposed to consider Dr Thompson's Pentacrinus as a species of Comatula.

31. *The third volume of Poli's great work, and on the animal of Argonauta Argo.*—The well-known Professor Stefano delle Chiage, a scholar of Poli, will, we understand, publish the continuation of that celebrated naturalist's work under the title Poli Testac. utr. Sic. tom. iii., cum additamentis et annotationibus, Stephani delle Chiage. Carus, who paid Chiage a visit some time ago, saw several of the engraved plates of the work; one of them, which displayed the shape, anatomy, and ova of the Argonauta Argo, he considered particularly interesting, because it exhibited, in embryo, within the ovum, the rudiments of the shell in which the animal lives, by which the question, whether the delicate shell in which the animal lives is its own or one foreign to it, is most satisfactorily answered.

32. *Humming Bird and Insects at a great height on the Volcano of Orizaba.*—Schiede and Deppe, on their ascent of Orizaba, observed, at a height of 10,000 feet above the sea, the Humming Bird (Trochilus) flying round the orange-coloured flowers of the Castilligen. At a height between 14,000 and 15,000 feet, on the same mountain, above the region of grasses, &c. they

found, under a block of porphyry, many moths, some dead, others alive, which appear to have been carried upwards into this snowy region by an ascending current of air. In the same dreary region, a live species of beetle was found, which, from its nature, must be considered a native of this lofty situation.

33. *Spur on the wing of the Rallus Crex.*—The wing of the *Rallus Crex*, or Corncraik, is furnished with a spur, as is the case with a good many other birds mentioned in a former Number of this Journal.

34. *An Electrical Molluscous Animal.*—Mr Calder mentioned to the Asiatic Society of Calcutta, a molluscous animal, which has the property of giving electric shocks, like the torpedo and gymnotus; but neither genus nor species of the animal is noticed. We hope Mr Collier will inquire after the animal, and let us know what it is.

35. *Species of Mussel exclusively employed as Bait in the Newfoundland Cod Fishery.*—The utility of the inhabitants of shells (shell-fish) to mankind is well known. The following fact, as it is connected with an important branch of commerce, is a further proof of the value of these animals in an economical point of view. It was communicated to M. Sander Rang by Bellanger, the captain of a French frigate, and is inserted in Sang's valuable work on the Mollusca. The captain, endeavouring to ascertain how it happened that the French cod-fishers on the Banks of Newfoundland were not so successful as the Americans, discovered that it was owing to these latter employing, as a bait, the animal of a species of mya (mussel), which abounds on several parts of the American coast; and he was the more confirmed in the truth of this fact, by observing that the French fishers, towards the conclusion of the season, purchased from the Americans the remaining portions of their bait, in order that they might the more speedily complete their cargo. Bellanger, who is well versed in conchology, examined this mya very carefully, and found that it was a species met with abundantly on the coasts of the French channel. To our readers interested in the kinds of bait used in the Newfoundland fishery, we recommend the perusal of Mr Cormack's valuable communication, vol. i. of the New Series of this Journal.

ARTS.

36. *Improvement in the Smelting of Iron.*—Heated air for blast furnaces has been used for some time at the Clyde Iron-Works, and with great success. Experiments have proved that iron is smelted by heated air, with three-fourths of the quantity of coals required, when cold air, that is, air not artificially heated, is employed for that purpose, while the produce of the furnace in iron, is at the same time, greatly increased. All the furnaces at Clyde Iron-Works are now blown with it. At these works the air, before it is thrown into the blast-furnaces, is heated 220° of Fahr. in cast-iron vessels placed on furnaces, similar to those of steam-engine boilers. It is expected that a higher temperature than 220° will be productive of a proportionally increased effect. But this is the subject of experiment. It is supposed that this improvement will accomplish a saving in the cost of the iron in Great Britain, to the amount of at least L. 200,000 a-year.

37. *Artificial Ultramarine.*—In preparing this pigment, we must be careful that the mass of silicated natron and alumina is as moist as possible. If it is too much dried before the addition of the sulphur, we will wait in vain for the appearance of the blue colour ; even a greenish-blue tint will not shew itself. But one and the same mass affords different kinds of ultramarine, which must be separated from each other by repeated washing. Gmelin remarks, that the success of the operation appears to depend on the co-operation of the air.—*Hermstadt.*

List of Patents granted in England from 2d July to 15th September 1829.

1829,

July 2. To E. Galloway, Southwark, for " improvements in steam-engines and machinery for propelling vessels."

To J. Perkins, London, engineer, for " improvements in machinery for propelling steam-vessels."

To T. Kelby, Wakefield, York, and H. F. Bacon, Leeds, " for their new or improved gas-lamp burner."

4. To R. Crabtree, Halesworth, Suffolk, " for his machine or apparatus for propelling carriages, vessels, and locomotive bodies."

July 4. To M. Knowles, Surrey, for "an improved method of constructing and forming ceilings and partitions for dwelling-houses, warehouses, work-shops, or other buildings, in order to render the same more secure against fire."

To G. K. Sculthorpe, Middlesex, gent. for "improvements on axles or axle-trees, and coach and other springs."

To J. C. Danniell, Bradford, Wilts, clothier, for "improvements in machinery applicable to dressing woollen cloth."

8. To W. Ramsbottom, Manchester, for "improvements in power-looms for weaving cloth."

To W. Leeson, Birmingham, for "improvements in harness and saddlery, part of which improvements are applicable to other purposes."

To M. Poole, Lincoln's Inn, Middlesex, for "improvements in harness and saddlery, part of which improvements are applicable to other purposes."

To M. Poole, Lincoln's Inn, Middlesex, for "improvements in the apparatus for raising or generating steam and currents of air, and for the application thereof to locomotive engines, and other purposes."

9. To T. Salmon, Stoke-ferry, Norfolk, for "his improved malt-kiln."

25. To G. Straker, South Shields, for "an improvement in ships' windlasses."

To L. Quetin, London, for "his improved vehicle, or combination of vehicles, for the carriage or conveyance of passengers and luggage."

To F. H. N. Drake, Esq. Colyton House, Devon, for "improvements in tiles for covering houses, and other buildings."

To J. Nicholls, Pershall, Stafford, for "improvements in the lever, and the application of its power."

To J. Bates, Bishopsgate Street, merchant, for "his improved method of constructing steam-boilers or generators, whereby the bulk of the boiler or generator, and the consumption of fuel, are reduced.

30. To J. Hutchinson, Liverpool, for "improvements in machinery for spinning cotton, silk, linen, woollen, and other fibrous substances."

Aug. 1. To J. Bates, of Bishopsgate Street-within, for "his new process or method of whitening sugar."

3. To N. Jocelyn, London, late of North America, for "improvements in the preparation for manufacture of blank forms for bankers' checks, bills of exchange, promissory-notes, post-bills, and other similar instruments, or securities for the exchange of payments of moneys, by which forgeries and alterations in the same are prevented or detected."

5. To J. Bailey, Leicester, frame-smith, for "improvements in machinery for making lace."

Aug. 5. To J. **Brown**, Birmingham, coach-maker, for "his improved coach, particularly adapted for public conveyance and luggage."

10. To W. **Shand**, Esq. Burn, Kincardineshire, for "improvements in distillation and evaporation."

J. J. **Macleod**, Esq. Westminster, for "improvements in preparing or manufacturing certain substances so as to produce barilla."

11. To J. **Rowland**, London, and C. **Macmillan**, London, for "their improved process or mode of constructing, forming, or making streetways, carriage-roads, and high-ways in general."

To J. H. **Rolfe**, Cheapside, musical-instrument maker, for "improvements upon the self-acting piano-forte."

14. To E. **Weeks**, King's Road, Chelsea, for "improvements in and upon certain apparatus, already known for the communicating of heat, by means of the circulation of fluid."

20. To J. **Mushet**, Regent Park, for "a certain medicine for gouty affections of the stomach, spasms, cramps, inflammations of the lungs, coughs, beyond any other medicine or application in like cases."

21. To J. **Jones**, Leeds, for "improvements in machinery. or apparatus for dressing and finishing woollen cloths.

To Lieut. W. **Roger**, London, for "improvements in the construction of anchors."

Sept. 2. To G. H. **Manton**, London, gunmaker, for "an improvement in the construction of locks for all kinds of fowling-pieces and fire-arms."

To J. **Tucker**, Middlesex, brewer, for improvements in the construction of cannon.

9. To T. S. **Brandreth**, Liverpool, for "a new method of applying animal power to machinery."

To J. A. **Fonzi**, Middlesex, for "improvements on fire-places."

To J. **Loames**, jun. of Wheeler Street, Spitalfields, soapmaker, for "a new preparation or manufacture of a certain material produced from a vegetable substance, and the application thereof to the purposes of applying light, and other uses.

To J. **Morgan**, Tipton, Stafford, for "a method of preparing iron-plates, or black plates for tinning."

Sept. 9. To Colonel R. **Torrens**, Croyden, Surrey, for "an apparatus for the purpose of communicating power and motion."

15. To D. **Laurence**, Strood, and J. C. **Ashford**, gunmakers, Kent, for "their improvements in apparatus to be applied to fowling-pieces and other fire-arms, in place of locks."

To Captain G. **Harris**, R. N. Brompton, Middlesex, for "his improvements in the manufacture of ropes and cordage, canvas, and other fabrics or articles, from substances hitherto unused for that purpose.

To J. **Milne**, Edinburgh, architect, for "a machine or engine for dressing stones used in masonry, by the assistance of a steam-engine, a winch, a horse, or water power, whereby a great quantity of manual labour will be saved.

List of Patents granted in Scotland from 16*th September to* 6*th December* 1829.

1829,

Sept. 16. To **William Pool** of the parish of St Michael on the Mount, in the city of Lincoln, smith, for "certain improvements in machinery for propelling vessels, and giving motion to mills, and other machinery."

23. To **Elijah Galloway** of King Street, in the burgh of Southwark, engineer, for "certain improvements in steam-engines, and in machinery for propelling vessels; which improvements are applicable to other purposes."

To **Joseph Ange Fonzi** of Upper Marylebone Street, in the county of Middlesex, Esq. for "certain improvements on, or additions, to fire-places."

To **John Tucker** of Hammersmith, in the county of Middlesex, brewer, for "certain improvements in the construction of cannon."

To **David Lawrence** of Strood, and **John Crundwell** of Ashford, gunmakers, both in the county of Kent, for "certain improvements in apparatus to be applied to fowling-pieces, and other fire-arms, in place of locks."

25. To **Joshua Bates** of Bishopsgate Street-within, in the city of London, merchant, for an invention, in consequence of a communication made to him by a certain foreigner residing abroad, "of a new process or method of whitening sugars."

To **Joshua Bates** of Bishopsgate Street-within, in the city of London, merchant, for an invention, in consequence of a communication made to him by a certain foreigner residing abroad, "of an improved method of constructing steam-boilers or generators, whereby the bulk of the boiler or generator, and the consumption of fuel, are considerably reduced."

Oct. 28. To **Ross Winans** of Vernon, in the county of Sussex, and of the province of New Jersey, in the United States of North America, presently residing in London, for "certain improvements in diminishing friction in wheel-carriages, to be used on rail-roads; and which improvements are applicable to other purposes."

To **William Shand** of the Burn, in the county of Kincardine, Esq. for "a certain improvement or improvements in distillation."

Nov. 3. To **William Rodger** of Norfolk Street, Strand, in the county of Middlesex, Lieutenant in the Navy, for "certain improvements in the construction of anchors."

6. To **Charles Turner Sturtevant** of Hackney, in the county of Middlesex, soap-boiler, for "certain improvements in the process of manufacturing soap."

THE

EDINBURGH NEW PHILOSOPHICAL JOURNAL.

Biographical Memoir of Sir BENJAMIN THOMSON, *Count Rumford.* By Baron CUVIER [*].

BENJAMIN THOMSON, more commonly known by his German title of Count Rumford, was born in 1753, in the English Colonies of North America, at a place then called Rumford, and at present Concord, belonging to the State of New Hampshire. His family, which was of English origin, cultivated some lands there; and he himself has said that he should probably have remained in the humble condition of his parents, had he not in childhood been deprived of the little means they were able to bequeath to him. Thus, like many other eminent literary characters, it was to early misfortune that he owed his subsequent good fortune and celebrity.

His father died young. His mother having married again, he was separated from her by his stepfather; and his grandfather, from whom alone he had any thing to expect, had disposed of all that he possessed in favour of a younger son, and left him in almost complete destitution.

There is nothing more calculated to induce a premature development of intellect than such a condition as this. The young Thomson attached himself to a clergyman of learning, who undertook to prepare him for the mercantile profession, by giving him a smattering of mathematics. But the good minister also spoke sometimes to him of astronomy, and his lessons in that science benefitted his pupil more than he had foreseen.

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[*] Read to the Institute of France.

The young man brought him one day the plan of an eclipse, which he had traced according to a method which had suggested itself to him on reflecting upon his master's discourses. It was found to be singularly accurate, and this success induced him to abandon all for science.

In Europe, the sciences might have afforded him some recompense; but, at that period, there was none in New Hampshire. Fortunately for him, he had obtained from nature what ensures a favourable reception at all periods and in all countries, a fine figure, and dignified and gentle manners. They procured for him, at the age of nineteen, the hand of a rich widow; and the poor scholar, at the moment when he least expected, became one of the great personages of the colony.

His good fortune was not of long duration. The discontent which the conduct of the Ministry and Parliament had, for ten years past, so imprudently cherished, now rose to the greatest extremity. The Government resolved on war, and New Hampshire was destined to be its first seat.

In the night of the 18th April 1775, the royal troops, marching from Boston, after having fought a first battle at Lexington, proceeded toward Concord; but, being presently assailed by a furious multitude, were obliged to betake themselves to their garrison. Mrs Thomson's family was attached to the government by important offices. Her husband, young as he was, had himself received from it some marks of confidence. His personal opinions, besides, led him to support the government. Thus it was natural that he should join the ministerial party with all the fervour of his age, and freely participate in its chances. He therefore retired to Boston with the army, and in such haste, that he was obliged to leave at Concord his wife, who was far advanced in pregnancy. Having afterwards to move from place to place, he never saw her again, nor was it until after a period of twenty years that he met the daughter to which she gave birth a few days after his departure.

It was undoubtedly an evil of not less magnitude to fight against his countrymen; but perhaps he did not view it as such, and that evil we shall only lament, without venturing to impute to him any blame. During the cruel period from which we have just emerged *, when almost all the states of Europe saw their citizens serving under opposite colours, each asserted that he was fighting for his country; and the chance of arms itself, which is the universal umpire, has not terminated this kind of contest. Fortunately, honour and fidelity are points respecting which there are no disputes, and in those happy moments, when reason, induced by exhaustion, at length puts an end to the bloody quarrels of nations, honour and fidelity rally all the virtuous and brave.

Mr Thomson remained firmly attached to the royal government, and served it with courage and address, whether in the field of battle or in the cabinet; but he did not participate in all the mad schemes of some of its partisans. Those against whom he fought always respected him, and of this feeling he received a very honourable proof at the end of the war, when several cities of the United States sent him urgent invitations to return.

It is well known that one of Washington's first exploits was to compel the English troops to evacuate Boston, on the 24th March 1776. Mr Thomson was employed to carry the news of this unfortunate affair to London. Missions of this kind are not generally such as procure rewards; but the prepossessing appearance of the young officer, and the accuracy and extent of the information which he gave, made a favourable impression on Lord George Sackville, then Secretary of State for the American department, and so celebrated for the misfortunes of his administration. He thought he had made a good acquisition by attaching such a man to his office, and having received abundant proofs of his talents and fidelity, raised him, in 1780, to the important post of under Secretary of State.

This appointment would have been a very advantageous one under a more able minister; but Mr Thomson soon experienced the most painful feeling that can affect an honourable man, that of the incapacity of his benefactor. The royal army seemed condemned to every kind of misfortune. Public opinion pronounced more decidedly against the ministers. To the re-

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* The period of the Revolution.

proaches which their imprudence might have merited, calumnies were added, as always happens when men in place are unsuccessful. Mr Thomson saw himself about to become the object of some of these imputations. He perceived that a desperate cause can only be served with honour by serving it at the peril of one's life, and he returned to the army, where he obtained the command of a division. This was at the commencement of 1782. The English were confined to Charleston, and reduced to a war of posts. Mr Thomson re-organised their cavalry, led it in several encounters, and had still such opportunities enough of distinguishing himself in the course of this campaign, that he was appointed to contribute to the defence of Jamaica, then threatened by the combined fleets of France and Spain; but the defeat of Count de Grasse averted the danger, and soon after peace was proclaimed, which put a close to Mr Thomson's military career.

Nothing could have happened to him so contrary to all his inclinations and hopes of advancement. He was thirty years of age, held the rank of colonel, enjoyed a high degree of reputation, and was ardently attached to his profession. He considered war so peculiarly suited to his genius, that seeing no appearance of it anywhere excepting between Austria and the Turks, he determined on offering his services to the Emperor. But his good destiny had decided differently from his inclination. When at Munich, on his journey, he found an opportunity of entering into a more advantageous although more pacific service. The ideas of his earlier years revived, and he was soon brought back to the sciences and the application of them, as to his true vocation.

He had never entirely forsaken them. In 1777, at the commencement of his residence in London, he had made curious experiments on the cohesion of bodies. In 1778, he had undertaken others on the force of gunpowder, which procured him admittance into the Royal Society; and, in 1779, he had embarked in the English fleet, chiefly with the view of repeating his experiments on a great scale. But, perhaps, amid the distractions of his military station, and even in the leisure of a private condition, he would only have made isolated trials, without a constant object, and without great results. He looked upon the sciences from a new point of view, when he required their assistance in a great military and civil administration. The statesman remembered that he was a natural philosopher and geometrician. His genius had assisted in establishing his credit; he employed his reputation to second his genius; and in this manner each new service that he rendered to the country which had attached him to itself, produced some discovery, and each discovery that he made enabled him to render some new service.

It was the late king who gave Mr Thomson to Bavaria. The young colonel, on his way to Vienna, passing through Strasburg, where the Prince Maximilian de Deux-Ponts, afterwards King of Bavaria, commanded a regiment, presented himself at parade on horseback, and in his uniform. At this time the whole conversation of the military turned on the American campaigns. It was natural for them to be desirous of hearing an English officer speak on the subject; he was therefore introduced to the prince, when some French officers were present, who had served in the opposite army. The manner in which he described what he had seen, the plans he showed, the original ideas he threw out, were a proof that Mr Thomson was a man of no ordinary acquirements; and the prince, knowing that he was to pass through Munich, gave him strong recommendations to his uncle, the reigning elector.

Charles Theodore, who, from being a mere prince of Sulzbach, had become, by the successive extinction of the chief branches of the Palatine house, sovereign of two electorates, was, in many respects, worthy of this favour of fortune. He was a man of intellect and education, and displayed a taste for science, and for all that announced greatness of mind: he encouraged the arts in his dominions, built beautiful palaces, and founded the Academy of Manheim. If he did not adopt in his government those maxims of philanthropy and toleration which now prevail in the counsels of princes, it is to be attributed to the epoch in which he received his education, an epoch in which Louis XIV. passed in Germany for the model and ideal of a perfect monarch. We have already said, and we shall see still more plainly in the sequel, that Mr Thomson's ideas were much of the same nature. He could not therefore fail to esteem the Elector, nor the Elector him; and, in fact, after the first interview, he received the offer of an appointment, and resolved to have no other master.

He travelled, therefore, rapidly to Vienna, and hastened to return to London, to obtain permission to enter into the service of Bavaria. This was granted to him, with flattering marks of satisfaction on the part of his government. The king knighted him, and allowed him the half-pay belonging to his rank, which he retained till the period of his death.

To the accomplishments and external advantages of which we have spoken, and the circumstance of his being an Englishman, which is always so great a recommendation on the continent, Sir Benjamin Thomson (for it was with this title that he returned to Munich in 1784) added a talent for pleasing, which could hardly have been anticipated in a man that had issued, as it were, from the forests of the new world. The elector, Charles Theodore, granted him the most marked favour: he made him successively his aide-de-camp, his chamberlain, member of his council of state, and lieutenant-general of his armies. He procured for him the decorations of the two orders of Poland, because the statutes of those of Bavaria did not then permit his admission to them. Lastly, in the interval between the death of the Emperor Joseph and the coronation of Leopold II., the Elector took advantage of the right which his functions, as vicar of the empire, gave him, to raise Sir Benjamin to the dignity of Count, by the name of the district of New Hampshire in which he was born.

Count Rumford has sometimes been blamed for the importance which he seems to have attached to distinctions, to which his real merit might have rendered him indifferent. They who have done so, however, have not sufficiently considered his situation. Formerly, a title without birth was of no estimation among us; but it is not so in England, where the title, as it were, metamorphoses the man, or in Germany, where one seldom receives a great office without, at the same time, receiving a corresponding title. Count Rumford, therefore, might think this custom necessary for the maintenance of a respect which he knew how to render so useful. We have besides seen, by a recent experiment made on the great scale, that some, not being philosophers enough to refuse titles when chance offered them, and others being apparently too much so to think that titles were worth the trouble of being refused, every body accepted them. We do not therefore condemn Count Rumford for having done like all the world; we even pardon beforehand those who may imitate him in this respect, provided they imitate him in other respects also.

His new master not only procured honourable distinctions for him, but also confided to him a real and very extensive power, by uniting in his person the administration of war and the direction of the police; and his reputation, besides, soon gave him a great influence over all parts of the government.

Most of those who have been led to power by the course of events, arrive there already misled by public opinion; they know that they will infallibly be called men of genius, and that they will be celebrated in prose and verse, if they succeed in changing in some point the forms of the government, or extending a few leagues the territory in which this government is exercised. Is it therefore surprising, that internal commotions and external wars incessantly disturb the repose of men? It is to themselves that men ought to look. Fortunately for Count Rumford, Bavaria could not at this period hold out these temptations to her ministers. Her constitution was fixed by the laws of the empire, her frontiers by the great powers that surrounded her; and she was reduced to the condition, which most states find so hard, of confining all her cares to ameliorating the condition of her people.

It is true that she had much to do in this respect. Her sovereigns, enriched at the period of the religious wars, in consequence of their zeal for catholicism, had long carried the marks of this zeal far beyond what an enlightened catholicism requires; they encouraged devotion, and did nothing for industry; there were more convents than manufactories in their territories; the army was almost reduced to nothing; ignorance and idleness predominated in all classes of society.

Time does not permit us to mention all the services which Count Rumford rendered to this country and its capital, and we are obliged to limit ourselves to a few of the more remarkable.

He first occupied himself with the army, in the organization of which, a peace of forty years had allowed gross abuses to be introduced. He found means of removing the soldier from the ill-treatment of officers, and of adding to his comfort at the same time that he diminished the expenses of the state. The equipment of the troops, their clothing and head-dress, became more suitable and more convenient. Each regiment had a garden, where the soldiers themselves reared the vegetables which they required, and a school in which their children received the elements of education. The military discipline was simplified; the soldier was brought nearer to the citizen; the privates had more facilities afforded them of becoming officers; and a school was at the same time established, in which young men of family might receive the most extensive military education. The artillery, as being more connected with the sciences, chiefly attracted the regard of Count Rumford, who made numerous experiments for its improvement. Lastly, he established a workhouse, in which were manufactured, with regularity, all the articles necessary for the troops—a house which, at the same time, became in his hands a source of improvement in the police still more important than those which he had introduced in the army.

After what we have said of the state of Bavaria, it will easily be conceived that mendicity must there have become excessive; and it was in fact asserted, that, next to Rome, Munich had the greatest number of beggars of any city in Europe. They obstructed the streets, divided the stations among each other, sold or inherited them as one does a house or a farm. Sometimes they were even seen to fight for the possession of a post or church-door; and, when opportunity presented, they did not refuse to commit the most revolting crimes.

It were easy to find by calculation that the regular support of this mass of wretches would cost the public less than the pretended charities which they extorted from it. Count Rumford had no difficulty in perceiving this; but he saw, at the same time, that to extirpate mendicity, something more was necessary than to prohibit it; that but half of the work would be done by arresting the mendicants and feeding them, unless their habits were changed, unless they were formed to industry and order, and unless there were inspired into the people a horror of idleness, and of the lamentable consequences which it induces.

His plan, therefore, embraced physics and morals. He pondered it long, proportioned all its parts to each other, and to the laws and resources of the country; prepared with vigour and in secret the details of its execution, and, when all was ready, directed it with firmness.

On the 1st of January 1790 all the beggars were led to the magistrates, and it was signified to them that they would find in the new workhouse whatever was necessary for their subsistence, but henceforth they were prohibited from begging.

In fact, there were provided for them materials and tools, large and well heated rooms, wholesome and cheap food. Their work was paid by the piece. At first it was imperfect, but they soon improved. The workmen were classed according to their progress, which also facilitated the arrangement of the products. Their employment was to produce clothing for the troops. At the end of some time there was an overplus, which was sold to the public, and even to other countries, so that ultimately there was an annual profit of upwards of 10,000 florins secured to the state.

The whole establishment was, at the commencement, amply supported by voluntary subscription, in which all classes of the inhabitants were made to feel interested, and which was much inferior to the sum of the alms that were formerly given.

And to change in this manner the deplorable condition of a degraded class, nothing was required but the habit of order and judicious management. Those wild and distrustful beings yielded to the dispositions that were manifested to promote their wellbeing. It was, says Count Rumford himself, by rendering them happy, that they were taught to become virtuous. Not even a child received a blow. Still more, the children were at first paid merely for looking on the work of their companions, and they soon came weeping to implore that they also should be set to work. Some praises properly bestowed, some handsomer dresses, recompensed good conduct, and excited emulation. The spirit of industry was roused by self-love, for the springs of the human heart are the same in the most opposite conditions, and the equivalent of a cordon of nobility exists even in the lowest grades of society.

It was not, however, the mendicants alone whose condition was ameliorated. The bashful and honest poor were also admitted to ask work and food. More than one woman of rank that had fallen into misfortune, obtained flax and soup from the commissioners, without being ever questioned, and among the brave of the Bavarian army, there were many who wore clothes that had been spun by a noble and delicate hand.

The success was such that not only were the poor completely succoured, but their number was greatly diminished, because they learned to support themselves. In one week two thousand five hundred had been registered, and some years after they were reduced to fourteen hundred. They even learned to feel a sort of pride in relieving their old companions; and nothing prevented better their asking alms, than having enjoyed the pleasure of bestowing them.

Although Count Rumford had been directed in his operations more by the calculations of a politician than by the impulses of a man of feeling, he could not help being truly moved at the sight of the change which he had effected, when he beheld on those countenances, formerly shrivelled by misfortune and vice, an air of satisfaction, and sometimes even tears of tenderness and gratitude. During a dangerous illness he heard a noise under his window, of which he enquired the cause. It was a procession of the poor who were going to the principal church, to implore of heaven the safety of their benefactor. He confessed himself that this spontaneous act of religious gratitude, in favour of a person of another communion, appeared to him the most affecting of recompenses; but he did not dissemble that he had obtained another, which will be more lasting. In fact, it was in labouring for the poor that he made his most important discoveries.

M. de Fontenelle said of Dodard, who, in rigorously observing the fasts prescribed by the Church, made accurate experiments on the changes which his abstinence produced in him, that he was the first who had taken the same path for getting to heaven and the academy. Count Rumford may be associated with him, if, as may be believed, the services rendered to men lead to heaven as surely as the practices of devotion. This much is certain, however, that it was to his benevolent schemes that he was indebted for the glory which his name will possess in the history of physics.

Every one knows that the object of his finest experiments was the nature of heat and light, as well as the laws of their propagation; and in this, what interested him was, to know how to feed, clothe, warm, and light with economy, a great assemblage of men. He first engaged in comparing the heat of different kinds of clothes. This, as is well known, is not an absolute heat, and we only mean by it the property of retaining that which is generated by our bodies, and of preventing its dissipation. Count Rumford enveloped thermometers raised to a higher temperature than the air with various substances, and observed the time they took in returning to a state of equilibrium. He arrived at this general result, that the principal retainer of heat is the air between the fibres of substances, and that these substances furnish clothes so much the warmer, the more they retain the air heated by the body. It is thus, and it will not fail to be remarked, that Nature has taken care to clothe the animals of cold countries.

Passing then to the examination of the most effectual means of economising fuel, he saw in his experiments that flame in the open air gave little heat, especially when it was not rapidly agitated, and did not strike vertically the bottom of the vessel. He also observed that the vapour of water conduced very little to heat when it was not in motion. Chance gave him the key of these phenomena, and opened up to him a new path of inquiry. Casting his eyes on the coloured liquor of a thermometer, which was cooling in the sun, he perceived in it a constant motion, which continued until the thermometer had fallen to the surrounding temperature. Some powders which he diffused in liquids of the same specific gravity, were also agitated whenever the temperature of the liquid changed, a circumstance which announced continual currents in the liquid itself. Count Rumford came to think that it was precisely by this transportation of molecules that the heat was distributed in the liquids, which by themselves would have allowed very little caloric to pass. Thus, when the heating commences below, the warm molecules, becoming lighter, ascend, and the cold molecules are precipitated to the bottom to be heated. This he verified by direct and ingenious experiments. So long as only the upper part of a column of liquid was heated, the lower part did not in any degree partake of the heat. A piece of red hot iron plunged in oil to a short distance from a bit of ice which lay at the bottom, did not melt a particle of it. A bit of ice kept under boiling water was two hours in melting, while at the surface it melted in three minutes. Whenever the internal motion of a liquid was arrested by the interposition of some non-conducting substance, the cooling or heating, in a word, the equilibrium, was retarded in it. Thus feathers or hair would produce the same effects in water as in air.

As it is known that fresh water is at its maximum of density at seven degrees above the freezing point, it becomes lighter a little before freezing. It is for this reason that ice always forms at the surface, and that once formed, it preserves the water which it covers. Count Rumford found in this property the means by which nature preserves a little fluidity and life in the countries of the north; for, if the communication of heat and cold took place in fluids as in solids, or only in fresh water as in other liquids, the streams and lakes would quickly be frozen to the bottom.

Snow, on account of the air which is mingled with it, was, in his eyes, the mantle which covers the earth in winter, and prevents it from losing all its heat. He saw in all this distinct precautions of Providence. He saw the same in the property which salt water possesses, the reverse of that of fresh water, by which, at all degrees of temperature, its molecules are precipitated when they are cooled; so that the ocean, being always temperate at its surface, softens the rigour of the winters along the shores, and warms again, by its currents, the polar climates, at the same time that it cools those of the equator.

The interest of Count Rumford's observations, therefore, extended, in some measure, to the whole economy of nature in our globe, and perhaps he made as many cases of those relations to them which he perceived in general philosophy, as of their utility in public and private economy.

Their mere announcement must have made my hearers anticipate this utility; and, besides, there is no one who does not know their effects from experience. It was by a regular application of these discoveries, that Count Rumford constructed fire-places, furnaces, and caldrons of new forms, which, from the hall to the kitchen and the workshop, have reduced the consumption of fuel by more than a half.

When we fancy to ourselves those enormous chimneys of our ancestors, in which whole trees were burnt, and which almost all smoked, we are astonished that the simple and sure improvement of Count Rumford was not sooner devised. But there must be some difficulty concealed in all those things which are found out so late, and which we call so simple when once they are discovered.

The improvements which Count Rumford made in the construction of kitchens, will have a more important, although a somewhat more tardy result, because somewhat more firm foundations must be laid for their first establishment The unfortunate cook himself, at present half roasted by the heat of his fire, will be enabled to operate calmly in a mild atmosphere, with an economy of three-fourths for fuel, and of one-half for time; and Count Rumford did not consider as of small importance this ease procured for those who prepare our food. As the same quantity of original matter furnishes a much greater or a much smaller quantity of nutrition, according as it is prepared, he looked on the art of cookery as equally interesting with that of agriculture. He did not confine himself to the art of cooking food at little expense, but also bestowed much attention on that of composing it. He discovered, for example, that the water which is incorporated with food becomes itself, by this mixture, a nutritive matter; and he tried, of all the alimentary substances, to find out that which nourishes most and at the smallest expense. He even made a study of the pleasure of eating, on which he wrote an express dissertation; not assuredly for himself, for his moderation was excessive, but in order also to discover the economical means of increasing and prolonging it, because he saw in it an intention of nature to excite the organs which are to concur in digestion.

It was by thus judiciously combining the choice of substances, with all possible economy in the art of preparing them, that he was enabled to support man at so little cost, and that, in all civilized countries, his name is now connected with the most efficacious aids that industry can receive. This honour much excels those which have been decreed to the Apiciuses of ancient and modern times; I would even venture to say, to many men who have been celebrated for discoveries of a higher order.

In one of his establishments at Munich, three women were sufficient to prepare a dinner for a thousand persons, and they burnt only ninepence worth of fuel. The kitchen which he constructed in the Hôpital de la Pièta at Verona, is still more perfect, there being burnt in it only the eighth part of the wood which was formerly consumed.

But it was in the employment of steam for heating, that Count Rumford, so to speak, surpassed himself. It is known that water kept in a vessel which it is unable to burst, acquires an enormous heat. Its vapour, at the moment when it is let loose, carries this heat wherever it is directed. Baths and apartments are thus heated with wonderful quickness. Applied to soapworks, and especially to distilleries, this method has already enriched several manufacturers of our southern departments; and in the countries where new discoveries are more slowly adopted, it has afforded immense advantages. The brewhouses and distilleries of England are heated in this way. In them a single small copper cauldron boils ten large wooden vats.

Count Rumford went so far in these improvements as even to economise all the heat of the smoke, which he only allowed to issue from his apparatus after it had become almost perfectly cold. A person justly celebrated for the elegance of his mind, said to him that he would soon cook his dinner with his neighbour's smoke. But it was not for himself that he sought economy. His varied and often repeated experiments, on the contrary, cost him much, and it was only by dint of lavishing his money, that he taught others to save theirs.

He made nearly as many researches on light as on heat, and among his results, the following observations are principally worthy of notice; that flame is always perfectly transparent and permeable to the light of another flame; and that the quantity of light is not in proportion to that of the heat, and that it does not depend, like the latter, upon the quantity of matter burnt, but rather upon the vivacities of the combustion. By combining these two observations, he invented a lamp with several parallel wicks, the flames of which, mutually exciting each other, without allowing any of the rays to be lost, are capable of producing an unlimited mass of light. It is said, that when it was lighted at Auteuil, it so dazzled the lamp-maker who had constructed it, that the poor man was unable to find his way home, and was obliged to pass the night in the wood of Boulogne.

I deem it superfluous to mention how he varied and adapted to all sorts of uses the different instruments that are employed for lighting. The Rumford lamps are not less diffused nor less popular than the chimneys and soups of the same name. This is the true character of a good invention.

He determined, by physical experiments, the rules that render the oppositions of colour agreeable. Few fine ladies imagine that the choice of a border, or of the embroidery of a ribbon, depends on the immutable laws of Nature, and yet such is the fact. When one looks steadily for some time at a spot of a certain colour on a white ground, it appears bordered with a different colour, which, however, is always the same with relation to that of the spot. This is what is called the complementary colour; and, for reasons which it were needless to develope here, the same two colours are always complementary to each other. It is by arranging them that harmony is produced, and the eye flattered in the most agreeable manner. Count Rumford, who did every thing by method, disposed, according to this rule, the colours of his furniture, and the pleasing effect of the whole was remarked by all who entered his apartments.

Continually struck, in all his labours, by the wonderful phenomena of heat and light, it was natural for him to attempt a general theory respecting these two great agents of nature. He considered them both as only effects of a vibratory motion impressed on the molecules of bodies, and he found a proof of this in the continual production of heat which takes place by friction. The firing of a brass gun, for example, putting water in a short time into a state of ebullition, and this ebullition lasting as long as the motion which produced it, he found it difficult to conceive how, in such a case, matter was disengaged, for it would require to be inexhaustible.

He moreover proved, better than any person, that heat has no weight. A phial of spirit of wine, and another of water, remained in equilibrium after the congelation of the latter, although it had lost by this, caloric enough to raise the same weight of gold to a white heat.

He invented two singularly ingenious instruments. The one, which is a new Calorimeter, serves to measure the quantity of heat produced by the combustion of a body. It is a box filled with a given quantity of water, through which the product of the combustion is made to pass by a serpentine tube; and the heat of this product transmitted to the water, raises it a determinate number of degrees, which serves as a basis to the calculations. The manner in which he prevents the external heat from altering his experiment, is very simple and ingenious. He commences the operation at some degrees below that heat, and terminates it at as many degrees above it. The external air resumes, during the second half, precisely what it had given out during the first. The other instrument serves to disclose the slightest differences in the temperature of bodies, or in the facility of its transmission. It consists of two glass balls filled with air, connected by a tube, in the middle of which is a bubble of coloured spirit of wine. The smallest increase of heat in one of the balls drives the bubble toward the other. This instrument chiefly, which he named a Thermoscope, made known to him the varied and powerful influence of different surfaces over the transmission of heat, and also pointed out to him numerous methods of retarding or accelerating, heating or cooling, at will.

These two last kinds of researches, and those which have reference to illumination, ought to interest us more particularly, because he had made them after he had fixed his residence at Paris, and taken an active part in all our occupations. He considered them as his contributions in quality of a member of the Institute.

Such are the principal scientific labours of Count Rumford, but they are far from being the only services which he rendered to science. He knew that, in discoveries, as in philanthropy, the work of an individual is transitory and limited, and, in the latter, as in the former, he strove to establish durable institutions. Thus he founded two prizes, which were to be annually assigned by the Royal Society of London, and the Philosophical Society of Philadelphia, to the author of the most important experiments on heat and light; an endowment by which, in evincing his zeal for natural philosophy, he also testified his respect for his native and for his adopted country, and proved, that, by having served the one, he had not quarrelled with the other.

He was the principal founder of the Royal Institution of London, one of the best contrived establishments for hastening the progress of science and its application to the arts. In a country where every individual prides himself on encouraging whatever can be of service to the community, the mere distribution of his Prospectus brought him considerable funds, and his activity would soon have led to its execution. The prospectus itself was already a sort of description, for he spoke in it of what he proposed as of a thing in a great measure realized: A vast house presented all kinds of trades and machines in action; a library was formed in it; a beautiful amphitheatre was constructed, in which were delivered lectures on chemistry, mechanics, and political economy. Heat and light, the two favourite subjects of Count Rumford, and the mysterious process of combustion, which puts them at the disposal of man, were to be continually submitted to examination.

This Prospectus is dated at London the 21st January 1800, and the foundation of the Royal Institution was the work of fifteen succeeding months which Count Rumford passed in England, with the hope of settling there.

After having been loaded, during fourteen years, by the Elector Charles Theodore, with proofs of an always increasing favour, after having received from him, at the period of the famous campaign of 1796, the difficult trust of commanding his army, and of maintaining the neutrality of his capital against the two great powers that seemed equally anxious to attack it, Count Rumford obtained from him as a final recompence, in 1798, the post which he most desired, that of Minister Plenipotentiary at the Court of Great Britain.

There could be nothing more flattering to him in fact than to be enabled to return among his countrymen, and, according to the noble expression of an ancient, to combine leisure with dignity. But his hopes were frustrated. The usage of the English Government does not permit, that a man born its subject should be accredited to it as the representative of another power; and the minister for foreign affairs signified to Count Rumford that it was resolved not to deviate from this usage.

A still more acute disappointment soon after befel him. He was informed of the death of the Prince, his benefactor, which happened in 1799, and he foresaw that he would have no less difficulty in resuming his old than in exercising his new functions. In reality, the Elector Joseph Maximilian was neither ignorant of his merit nor of his services, and remembered that he was the first author of his fortune; but, with a different system of government, and opposite political interests, it was natural that he should have other counsellors than his predecessor, and Count Rumford was not of a character to enter into partnership. Besides, the happy changes which he had effected, had rendered him less necessary, and his views, which had been so useful when Bavaria required to be enlightened, were no longer such as suited, precisely because the success of their adoption had already been so rapid.

He therefore only returned to Munich for a short time, during the peace of Amiens; and yet even in this short time, he performed a true and great service to science, in contributing, by his advice, to the reorganization of the Bavarian Academy, on a plan which, with utility, in every respect, combined a truly royal magnificence.

The period at length arrived when a final retreat had become necessary. And it was no mean honour for France, that a man who had enjoyed the consideration of the most civilized countries of the two worlds, preferred it for his last residence. He preferred France, because he quickly perceived it to be the country where merited reputation most surely gains a true dignity, independent of the transitory favour of courts, and of all the chances of fortune.

In fact, we have seen him among us for ten years, honoured by Frenchmen and foreigners, esteemed by the friends of science, participating their labours, aiding with his advice even the meanest artizans, nobly gratifying the public with a constant succession of useful inventions.

Nothing would have been wanting to his happiness, had the amenity of his behaviour equalled his ardour for public utility. But it must be acknowledged, that he manifested, in his conversation and in his whole conduct, a feeling which must appear very extraordinary in a man so uniformly well treated by others, and who had himself done so much good. It was without loving or esteeming his fellow-creatures, that he had done them all these services. Apparently, the vile passions which he had observed in the wretches committed to his care, or those other passions, not less vile, which his good fortune had excited among his rivals, had soured him against human nature. Nor did he think that the care of their own welfare ought to be confided to men in common. That desire, which seems to them so natural, of examining how they are ruled, was in his eyes but a factitious product of false knowledge. He had nearly the same ideas of slavery as a planter, and he considered the Chinese government as the nearest to perfection; because, in delivering up the people to the absolute power of men of knowledge alone, and in raising each of these in the hierarchy, according to the degree of his knowledge, it made in some measure so many millions of hands the passive organs of the will of a few good heads;—a doctrine which we mention without in any degree pretending to justify it, and which we know to be little adapted to the ideas of European nations.

Count Rumford himself experienced, more than once, that it is not so easy in the west as in China, to engage other men to be nothing but hands; and yet no one was so well prepared as he to make good use of the hands that might be submitted to him.

An empire, such as he conceived, would not have been more difficult for him to manage, than his barracks and poor-houses. For this he trusted especially to the power of order. He called order the necessary auxiliary of genius, the only possible instrument of real good, and almost a subordinate divinity regulating this lower world. He purposed to make it the subject of a work which he thought would be more important than all that he had written; but of this work there were found among his papers only a few unconnected materials. He himself, in his person, was, in all imaginable points, a model of order. His wants, his pleasures, and his labours, were calculated, like his experiments. He drank nothing but water, and ate only fried or roasted meat, because boiled meat, in the same bulk, does not afford quite so much nutriment. In short, he permitted in himself nothing superfluous, not even a step or a word, and it was in the strictest sense that he took the word *superfluous*.

This was no doubt a sure means of devoting his whole strength to useful pursuits, but it could not make him an agreeable being in the society of his fellows. The world requires a little more freedom, and is so constituted that a certain height of perfection often appears to it a defect, when the person does not take as much pains to conceal his knowledge as he has taken to acquire it.

Whatever Count Rumford's sentiments were with respect to men, they diminished nothing of his respect for the Divinity. In his works, he neglected no opportunity of expressing his religious admiration of Providence, and of offering to the admiration of others the innumerable and varied precautions of Providence for the preservation of his creatures. Perhaps even his system of politics was derived from the circumstance of his imagining that princes ought to act in like manner, and take care of their subjects, without being accountable to them.

This rigorous observance of order, which probably marred the pleasure of his life, did not contribute to prolong it. A sudden and violent fever carried him off, in his full vigour, at the age of sixty-one. He died on the 21st August 1814, in his country house of Auteuil, where he passed the summer.

The notice of his obsequies arriving only at the same time with the news of his death, did not allow his fellow members to perform the accustomed honours at his tomb. But, if such honours, if any efforts to extend renown and render it durable, were ever superfluous, it would be for the man who, by the happy choice of the subjects of his labours, had richly earned the esteem of the learned, and the gratitude of the unfortunate.

Observations on the Action of the Mineral Acids on Copper, under different circumstances. By John Davy, M. D., F. R. S., Physician to the Forces. Communicated by Sir James Macgrigor, Director-General of the Army Medical Board, &c. *

My Dear Sir, London, *December* 24. 1829.

If you think the accompanying paper of any interest, will you do me the honour of publishing it in your Journal. It was written, as you will perceive by the date of it, more than two years ago, and before M. Bequerel had published either of his very important dissertations on the application of feeble electro-chemical powers to produce new combinations. The results contained in my papers are precisely of the same class as those more ingeniously and ably obtained by the French chemist. The circumstance which principally renders them, in my opinion, deserving of some notice, is the facility of making the experiments, no complicated apparatus being required, or any manual dexterity. I am, &c.

John Davy.

To Professor Jameson, &c.

In a paper published in the Philosophical Transactions of 1826, I described certain changes which I had witnessed in some ancient alloys of copper, attributable to the operation of electro-chemical attraction, acting very slowly and in the manner of a mineralizing process.

In this paper I shall describe the results of some experiments which I have been induced to make on the action of the mineral acids on copper, placed in different circumstances, with the hope of illustrating the changes just alluded to, and of obtaining a farther insight into phenomena of an obscure kind and interesting nature, at least in their bearings in relation to the mineral kingdom.

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* This interesting paper, as I observe by a note on the margin, was sent to England for publication, and reached London in July 1827.

I shall first mention the experiments which I have made with these acids, atmospheric air having been excluded, or nearly so. Sixty drops of each of the three mineral acids were diluted with six ounces of distilled water, a quantity equal exactly to the capacity of the phials employed. In these mixtures, small bars of polished copper were immersed, and the phials were closed with glass stopples, smeared with a composition of wax and oil. After the lapse of sixty-nine days, viz. from the 25th May to the 3d August, the results were examined, and were found to be the following:

The dilute sulphuric acid was colourless, had a just perceptible taste of sulphate of copper, and, on the addition of ammonia, acquired a faint blue hue, and the bar of copper was slightly tarnished with black oxide of copper, not equally over its whole surface, but more in some places than in others.

The results in the instance of the dilute muriatic acid were very similar; ammonia imparted to it a bluish tint, just perceptible, and black oxide of copper tarnished the bar in such a manner, as to produce the appearance of successive strata, with intervals between them, where the brightness of the metal was but little impaired.

The results with the dilute nitric acid were somewhat different. The acid had acquired a bright blue colour, and the metal was covered with a very thin and slightly adhering crust of black oxide, which was more copiously formed about the middle of the bar than at its extremities, and a little air was generated, which was probably either azote or nitrous oxide, for it did not produce a red fume on the addition of atmospheric air.

Without stopping now to reason on these phenomena, I shall proceed to describe another set of experiments, differing chiefly from the preceding in this circumstance, that the glass-vessels full of the dilute acids, in which the copper bars were immersed, were covered only with glass, so as to *retard evaporation*, but not *prevent* the *entrance of atmospheric air*. After an interval of eight months, viz. from the 3d August to the 2d April, the results were examined.

The sulphuric acid was found saturated with copper, and the bar covered with a thin crust of black oxide of copper, and *uniformly* covered, with the exception of the upper part of it, which was almost free from stain to the extent of about two lines, which was more corroded than the surface in general, and which, from evaporation, rose above the fluid. The *nitric acid*, too, was found saturated, and the top of the bar of copper projecting a very little above the surface of the solution, but it was still moist. There was a pretty considerable deposition of protoxide of copper on the bar, with a little subnitrate of copper, and a very minute quantity of copper in its metallic state. The subnitrate was found chiefly at the two extremities of the bar; the *protoxide* was very generally deposited, whilst the *metallic copper* was almost entirely confined to one side, and to a small space towards the upper end of the bar. The deposition being crystallized, and the colours bright and distinct, the appearance it made was brilliant, especially when placed in the sunshine, and resembling, in miniature, native specimens of the same kind.

The results in the instance of the muriatic acid were very similar; submuriate, protoxide, and metallic copper, were deposited. The submuriate was very abundant, and collected chiefly about the lower part of the bar, where it had formed crystallized plates, not unlike what is seen in the native specimens of this mineral from Peru. The protoxide was in a smaller quantity than in the preceding experiment, as well as the metallic copper, and their crystalline form was less distinct.

I have made a third set of experiments, with this difference only in conducting them, that the bar of copper, in each instance, was only half immersed in the dilute acid, and that atmospheric air had free access, in consequence of which, evaporation of the fluid went on pretty rapidly, and it was necessary every now and then to add water, to prevent desiccation. I do not consider it necessary to describe the results minutely; they were much the same as those obtained when atmospheric air was admitted, and evaporation partially prevented, excepting in the case of the sulphuric acid, in which, on this occasion, the charges were analogous to those exhibited with the other two acids; thus far, at least, that protoxide of copper was deposited, and a slight trace of metallic copper.

Having now described the facts which I have observed relative to the action of the mineral acids on copper in these different circumstances, I have little else to add. The phenomena are evidently of the same class as those which were the subject of my former paper, and equally referable to electro-chemical action. In the first set of experiments, in which atmospheric air was excluded, or very nearly so, scarcely any change was observable, excepting in the instance of the nitric acid, and the change in that case was probably connected with the decomposition of a small part of the acid. In the second set of experiments, on the contrary, the changes which took place were numerous and complicated, owing to the presence of atmospheric air, and the reaction of the combinations formed on each other. And, in the third set, in which the circumstances of the experiments were still more various, the effects were produced *more rapidly*, though *less distinctly*, and as well in the instance of the *sulphuric* acid as of the nitric and muriatic. It may appear extraordinary, that the peroxide of copper was formed, and, I may say, deposited in the first set of experiments, and that it was not dissolved by the acids. To what cause the formation and deposition of this oxide was owing, I am at a loss to conceive, and I can offer no suggestion in the least satisfactory to myself. It is almost as obscure as an effect which I have observed, on immersing a polished bar of copper in a neutral solution of sulphate of copper, when copper in its metallic state, in very minute quantity, is precipitated *. The black oxide not being dissolved when deposited is not surprising, considering that it is an oxide of difficult solubility, even in the *strong mineral acids*, and *much more so* when these acids are *diluted* with water. Why the *protoxide* of copper should have made its appearance when *atmospheric air* was admitted in the experiments, and *only* then, is probably owing to the action of an electro-chemical cause. Moreover, I may remark, that, when copper is either put into an open fire or left in distilled water, exposed to the action of atmospheric air, the *same* oxide is formed; and, in the *latter instance*, the colouring effect is so brilliant and beautiful, when the metal has been previously polished, that it has occurred to me, that thus coloured ruby-red, it might be useful in the ornamental arts.

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* This I conceived might have been occasioned by the sun's rays; for it was in making some experiments on their chemical agency, that I first noticed the phenomenon; but my conjecture was not confirmed on repeating the trial in the dark, when the same precipitation occurred.

To conclude. The phenomena noticed in the foregoing experiments (so like what we see in the mineral kingdom), in which, in the same specimen, we often witness the mixture of native copper and its protoxide, and some combination with an acid, offer an analogy not destitute of interest, and which may serve to explain circumstances which have hitherto been enveloped in mystery, as, the manner in which these minerals originated, thus grouped together, and, I was about to add, the manner in which they are preserved, retaining their lustre almost equally unimpaired in the recesses of the metallic vein, and in the cabinet of the mineralogist; but this latter peculiarity has already been explained most satisfactorily, by the electro-chemical researches of Sir Humphry Davy.

CORFU, *April* 17. 1827.

On the Mean Temperature of the Atmosphere and of the Earth, in some parts of East Russia. By Professor A. T. KUPFFER. With a Plate of Isogeothermal Lines.

THE thermometrical observations, which form the basis of the following determinations, were made with rectified thermometers. I first determined with care the error of a mercurial thermometer of Pixii, in Paris, which I intended to use as a normal thermometer. I did this according to the method described by Bessel, in these Annals, b. 82, p. 287, a very necessary precaution; for, although the boiling and freezing points were pretty accurately fixed, yet the error of the instrument, one way or another, amounted to a whole degree. With this normal thermometer, the others were now carefully compared, and their indications corrected by a table formed for the purpose.

Temperature of the Air in Kasan.

This was daily observed in the shade, for a whole year, at 9 A. M., 12 noon, 3 and 9 P. M., in an apartment selected for the purpose, in the garden of the University. For three months the highest and lowest temperatures were also daily observed. For that purpose, in want of a better instrument, the following arrangement was given to a common mercurial thermometer:—After the above thermometer was finished, I warmed the bulb, till the quicksilver ascended almost to the top of the tube; it was then quickly plunged with its open end in boiling alcohol, a little of which entered the tube. A small cylinder of steel (piece of a needle) was sunk in the alcohol, which, on holding the thermometer in the perpendicular position, soon fell down on the surface of the quicksilver. A portion of the alcohol was then removed, till not more than a filament, ten degrees long, remained in the tube; a little mercury was then allowed to enter, in order to confine the alcohol, and then air, which filled the upper end of the tube, which was closed with some cotton. It is easily seen, that, if we first bring the small steel cylinder in contact with the surface of the filament of mercury in connexion with the bulb, and then place the thermometer in the horizontal position, the cylinder will be continually pushed forwards, while the mercury expands by heat; but, when the temperature has reached it maximum, and begins to decline, the cylinder remains on the spot to which the mercury has pushed it. If now we make an observation, the distance of the cylinder of steel, from the surface of the contracted filament of mercury, will give the number of degrees which one must add to the temperature at the time of observation, to find the previous maximum of temperature. To obtain now the corresponding minimum, we bring the cylinder in contact with that filament of mercury which confines the alcohol, by holding the thermometer for some moments reversed, with the bulb uppermost, by which the cylinder will slowly slide down. When now, by increasing cold, the mercury contracts, the cylinder is pushed on by the second mercurial filament, and finally rests (if the thermometer lies horizontal), where the temperature has attained its minimum.

The following table contains the mean for every month, from November 1827 to November 1828. The thermometer is Fahrenheit's.

Month.	9 A. M.	12 Noon.	3 P. M.	9 P. M.	Maximum.	Minimum.	Mean of Max. and Min.
1827.							
November,	27°.27	30°.87	30°.65	27°.5			
December,	13.10	15.80	15.13	14.23	18°.95	6°.13	12°.54
1828.							
January, .	—2.65	0.5	0.72	0.27	2.97	—7.37	—2.2
February,	—2.87	2.52	4.32	—2.87	6.80	—10.75	—1.97
March, . .	21.87	27.95	29.52	21.87			
April, . . .	42.57	47.52	48.87	40.77			
May, . . .	57.65	62.60	63.95	54.05			
June, . . .	67.55	72.50	73.85	63.27			
July, . . .	65.30	71.15	72.27	63.95			
August, . .	63.27	69.35	70.47	61.47			
September,	45.05	53.15	54.95	46.17			
October, .	37.40	39.87	40.77	36.72			
Mean, . .	36.5	37.4	37.62	35.6			

The greatest cold was on the 18th and 19th January (—39°.32 the mercury froze); the greatest heat on the 8th July (87°.8).

To deduce from these observations the mean temperature of the air in Kasan, we may assume, without fearing any great error, that the mean of the observations made at 9 A. M., correspond to the mean temperature of the whole year; as here we are only considering one year, which is certainly not sufficient, exactly to determine the mean temperature of a place. It is known that we approach nearest to the true mean temperature, when we take the mean of the maxima and minima; but, that this mean comes very near the mean of the observations at 9 A. M., we may convince ourselves of, at least for three months, from the above table. We may also consult the works of Bouvard (Mem. de l'Acad. des Sciences, 1824), and Hallström (Poggendorf, b. 80, p. 373.)

The mean temperature of the air in Kasan, for the year 1828 (or, more correctly, from November 1827 to November 1828), is therefore 36°.5 Fahrenheit; but it is observable that the year 1828 was a cold year: the true mean temperature of Kasan must, therefore, be taken at somewhat higher. The mean temperature of April is considerably higher than the mean of the year; that of October not only approaches very near the mean of 1828, but also corresponds, as we shall immediately see, almost exactly to the mean temperature of Kasan.

The thermometer stood seven months above, and five below, the freezing point.

The mean temperature of winter, that is Dec. Jan. Feb. = 2°.52.
spring, — March, April, May, = 40 .77.
summer, — June, July, Aug. = 65 .30.
autumn, — Sept. Oct. Nov. = 36 .50.

Farther,

The temperature of the hottest month, . = 67°.55
coldest month, . = 2 .87

Professor Bronner, during his residence at Kasan, in the years 1814 to 1817, has likewise made thermometrical observations, the results of which are calculated by Professor Fr. Parrot in Dorpat, and published in "Erdmann's Contributions towards the Knowledge of the Interior of Russia," Part I. It is a pity that Professor Parrot has continued, in his calculation, the divisions of the Julian Calendar, which is still used in Russia; so that the mean temperature of the individual months are not comparable with the means calculated for other places; but this has, of course, no influence on the mean temperature of the year.

The observations were at 7 A. M., 12 noon, and sometimes 8, sometimes 9 P. M., and gave the following results:

	1814.	1815.	1816.	1817.	Mean.
Mean of all the Observations,	37°.62	38°.07	39°.87	35°.37	37°.85
Mean of the Observations at 7 A. M. and 12 noon,	Wanting.	37.17	38.97	36.50	37.62

If we add to this the result of 1828, we obtain 37°.4 as the true mean temperature of Kasan, about 120 feet above the level of the sea.

I put also the mean temperature of April and October into the quoted years. As Professor Parrot has calculated the mean for the Julian months, I first, taking the observations of 1828 as a basis, inquired, whether the mean of the Julian March and April, did not approximate to the mean of the Gregorian April, and the mean of the Julian September and October to the mean of the Gregorian October, and found that it was really the case; and now we have, from Bronner's table, the mean temperature for the Julian months March, April, September and October, calculated two and two, and the results viewed as the mean temperatures of the Gregorian months of April and October.

		From all Observations.	From Observations at 7 A. M. and 12 noon.
1814,	April, ...	33°.80	
	October, . . .	39.42	
1815,	April, ...	36.72	36°.72
	October, . . .	38.30	38.52
1816,	April, ...	34.70	35.37
	October, . . .	39.87	40.32
1817,	April, ...	37.40	38.52
	October, . . .	32.	32.45
Mean,	April, ...	35.6	36.95
	October, . . .	37.4	37.17

Temperature of the Earth in Kasan.

The temperature of the earth is indicated by springs, which issue forth in sufficient quantity and velocity, not to be affected by the temperature of the air. The temperature of such springs changes very little, and their changes are subject to different periods from those in the temperature of the air; the maximum and minimum falls much later than in the corresponding points in the temperature of the air. Springs, in mountainous districts, seem not to give so certainly the temperature of the earth as those in plains, because, in the former, we are never certain that they do not take their origin at a considerably greater elevation, and issuing forth at a lower point, indicate a lower temperature than belongs to the ground from which they flow. As little can we select springs flowing to the surface from marshy ground.

It sometimes happens that the earth's temperature, in any place, may be fixed with greater certainty, if springs, issuing at the same time from different points and kind of ground, shew a temperature nearly the same, and almost uniform throughout the whole year.

Springs which, before they issue forth or are formed, collect in considerable numbers into a common reservoir, shew also a very constant temperature; but, since they are always in contact with the air, so their temperature approaches the mean temperature of the air; so that in high latitudes, where the temperature of the earth is more elevated than the mean temperature of the air, these reservoirs are colder than the proper springs. The same is the case with wells of at least twenty feet deep, where the cooling may be more considerable, from the colder air always sinking downwards.

In Kasan I have observed the temperature of two springs well adapted for these inquiries. The first rises from a limestone rock at the bottom of the hill on which the citadel is placed, and on its north side; it is pretty copious, and holds in solution a large quantity of lime: the second is at Butiska, in the neighbourhood of Kabon, and not far from the archiepiscopal Palace. Several springs here rise in a curved line, and, by their union, form a rivulet, which is continually enlarging; one of them, near the bridge, rushes forth from the bed of the rivulet, with sufficient force to create considerable agitation in the water flowing over it. The thermometer was placed in the spring itself, as deep as possible, and at a season when the water of the rivulet had almost the same temperature as the spring itself. The water of this spring holds also in solution a little lime, but much less than the former.

Notwithstanding these springs were above a German mile distant from one another, and issue from very different soils, yet the temperature of both, on 29th October 1828 (temperature of the air about 32°), was found about 43°.7. Bronner found the temperature of the first spring, on the 16th January 1815, 42°.8. I found it, fourteen years afterwards, in the same month, scarcely even so much. These two observations are, properly speaking, not sufficient to fix with precision the temperature of the earth, and it is desirable that, in future, they should be continued into every month; but we may, by a comparison of these with other observations, draw conclusions approaching very near to the truth. For this comparison Erman's observations on the changes of temperature in the spring of Julienthaler, in Konigsberg (See these Annals, July 1827, part x. p. 302.), will be useful, which are contained in the following table:

October, . . .	49°.41	April, ...	44°.73
November, . . .	47.97	May, ...	45.18
December, . . .	46.53	June, ...	46.58
January, . . .	45.02	July, ...	48.02
February, . . .	44.19	August, . . .	49.23
March, . . .	43.74	September, . . .	49.77

The four last numbers are calculated.

We see, from these observations, that the minimum of temperature falls in March, the maximum in September; the mean of both gives 46°.76: therefore, very near the mean temperature of the earth, calculated from all the observations which Erman finds, 46°.70. The difference of temperature for January and October, is, for the Konigsberg spring, 4°.39; for the Kasan spring, 0°.9, that is nearly five times less; it is therefore probable that the fifth part of the changes of the Konigsberg spring very nearly expresses the changes for the Kasan spring. We thus obtain for Kasan:

September, . $43.7 + \frac{1}{5}(49^\circ.77 - 49^\circ.41) = 43^\circ.77.$

March, . . $42.8 - \frac{1}{5}(45.03 - 43.74) = 42.55.$

Mean, . $= 43.16.$

We may therefore regard 43°.2 as the true mean temperature of the earth at Kasan.

The temperature of springs depends on many, often variable, circumstances, and especially on the quantity of water which is renewed in a certain time. A well not far from the second spring, the level of whose water was only about twelve feet under the surface of the ground, and was scarcely two feet deep, whose water was therefore continually renewed (for this well supplies the whole village, at the Archiepiscopal Palace), shewed, on the 19th July 1828, 43°.81. Another well, in the village of Butiska, likewise not far from the second spring, but which was little used, and the level of its water twenty feet under that of the earth, shewed, on the 19th July 1828, 41°.56; on the 29th October of the same year, 42°.12. This temperature of 42°.12 was also that of a small spring on the 4th November, enclosed in a wooden basin, scarcely two feet under the surface of the ground, at the country-house of Professor Vogel, at the foot of the ridge of hills which skirts the left bank of the Kasanka. If we combine the observations of the 29th July and 19th October, as above, we obtain for the mean temperature of the wells at Kasan 41°.13.

The mean temperature of wells in Kasan is therefore about 2°.03 less than the mean temperature of the earth, and resemble the temperature of the atmosphere in their changes being greater in the observations brought forward, and double as much as the temperature of the earth.

In Kasan, the mean temperature of the wells is a little more than the mean between that of the air and earth.

Mean Temperature of the Air in Slatoust (Lat. 55° 8′, Long. 57° *from Paris; Elevation above the level of the sea* 370 *metres*).

Dr Eversmann, now professor of Natural History in Kasan, during the years 1817–1820, made thermometrical observations in Slatoust, with a thermometer, whose freezing and boiling points were accurately adjusted. The observations of 1818 and 1819 are complete; for 1817 and 1820, I calculated merely the means for the months of April and October.

It would indicate the greatest cold in the morning, the greatest heat about 2 P. M.; but as these observations were not made with a register-thermometer, we are not certain whether the highest and lowest temperature was observed.

Observations were also made at 12, 6, and 10; but as the mean of the maxima and minima gives most exactly the mean temperature of the year, so in the calculation of the latter no regard was paid to these observations. The following table contains the monthly mean:—

	1818.			1819.		
	Min.	Max.	Mean.	Min.	Max.	Mean.
January, . .	— 0°.06	10°.22	5°.09	3°.27	10°.67	6°.97
February, . .	—11 .26	5 .95	—2 .65	—8 .05	9 .14	0 .54
March, . . .	14 .92	33 .14	24 .23	9 .19	28 .13	18 .66
April, . . .	29 .35	44 .40	36 .86	28 .97	43 .61	36 .27
May, . . .	38 .95	57 .24	48 .09	43 .72	56 .70	50 .21
June, . . .	53 .08	70 .83	61 .95	53 .28	67 .79	60 .53
July, . . .	51 .23	63 .72	57 .47	57 .60	73 .98	65 .79
August, . .	52 .25	72 .14	62 .19	51 .01	63 .20	57 .11
September, .	40 .30	54 .95	47 .63	44 .88	58 .28	51 .58
October, . .	23 .48	32 .22	27 .85	34 .61	47 .75	41 .18
November, .	14 .16	19 .18	16 .67	13 .55	19 .74	16 .64
December, .	7 .70	14 .29	11 .00	—5 .57	2 .52	—1 .52
Mean, . . .	26 .17	39 .83	33 .01	27 .21	40 .12	33 .66

		1818.	1819.
Mean of the three	Winter months, Dec. Jan. Feb., . .	4°.48	2°.01
....	Spring months, . . .	36 .34	35 .06
....	Summer months, . .	60 .55	61 .13
....	Autumn months, . .	30 .72	36 .47

The mean temperatures of the months of April and October of 1817 and 1820 were—

	1817.			1820.		
	Min.	Max.	Mean.	Min.	Max.	Mean.
April, . . .	33°.12	52°.25	42°.57	33°.57	46°.17	39°.87
October, . .	24 .8	32 .67	28 .62	28 .85	42 .57	35 .82

Mean of all the four April observations, = 38°.88.
.... October do., . . = 33 .37.

Hence the most probable mean temperature of the atmosphere at Slatoust + 33°.35.

From the above table is the mean of the temperatures of all the months of the years 1818 and 1819 also = 33°.35.

Temperature of the Earth in Kisnekejewa (Lat. 54° 30′, Long. 60°), *on the east side of the Urals,* 300 *metres above the level of the sea.*

In the copper-mine of Kisnekejewa, a level, which opens on the declivity of the mountain, leads to a shaft twenty-five metres deep; here the temperature of a collection of water was 39°.87. This station has not been wrought for a long period.

Temperature of the Earth at Bogoslowsk (Lat. 60°, Long. 60°), *height above the sea* 200 *metres.*

In the copper-mine of Turinski, east from Bogoslowsk, the temperature of the mine-water, at the depth of 112 metres, is 43°.25. In the mine of Frolow, not far from the former, the mine-water, at a depth of 65 metres, has a temperature of 39.°2; the water here filled the deepest part of the works, shewing that they had been long unwrought. A spring, which issues forth at a depth of 56 metres, shewed 38°.07.

We may, by comparing the differences of the observed temperatures with the differences of the depths, deduce the law of the increase of temperature as we descend, as is seen from the following view:—

	Depths in Metres.	Temp.	Difference of the Depths.	Difference of Temp.	Depth for 2°.25 of Fahr.
No. 1.	56	38°.07	No. 3. —No. 1. = 56	5°.17	24°.3
... 2.	65	39 .2	No. 3. —No. 2. = 47	4 .05	26 .1
... 3.	112	43 .25	No. 2. —No. 1. = 9	1 .12	18 .0
			Sum, 112	10 .34	

As the amounts contained in the last column are more correct the greater the differences of depth, it is not correct to take the mean from them: we would obtain a more exact value, which yet does not require more calculation (as the operation from the theory of the least squares would demand), if we divide the sum of the differences of depths by the sum of the differences of temperature, we would thus obtain 2°.25 as the increase of temperature for every 24.4 metres of descent.

We will compare these observations with those collected by Cordier in his treatise, "Essai sur la Temperature de l'Interieur de la Terre," *Annales du Museum d'Histoire naturelle* (8. Annee, 3. Cahier)*. It is here to be observed, that, to obtain correct results, the temperature of mines cannot be compared with the mean temperature of the air, but only one mine-station with another; that the superior station be not too near the surface of the ground; that, finally, the lower station be at a sufficient depth. If we proceed in this way, many irregularities vanish, which Cordier met with in comparing his observations.

	Depth in Metres.	Temp. C.	Difference of Depths.	Difference of Temp.	Depth for 1° C.
I. *Temperature of Springs in Mines.*					
Saxony, ...	78 256	9.4 13.8	178	4°.4	40.5
Brittany, . . .	39 140	11.9 14.6	101	2.7	37.4
II. *Temperature of the Mine-Water.*					
Cornwall, . . .	82.3 274.5	15.6 25.6	192.2	10.0	19.2
III. *Temperature of large collections of Water in Mines.*					
Cornwall, . . .	71.4 329.4	15 26.7	258.0	11.1	23.2
IV. *Temperature of the Rock.*					
Saxony, ...	180 260	11.25 15.00	80	3.75	21.3
Littry, ...	0 99	11.00 16.1	99	5.1	19.4
Decise, ...	107 171	17.78 22.10	64	4.32	14.8

The last five observations may be used with some safety in the determination of the increase of temperature with the depth. The two first exceed the other too much, to admit of their being employed in the determination of the mean. Here, again, dividing the sum of the differences of the depths by the sum of the differences of temperatures, we obtain, as the depth corresponding to 1° c., 20.2 metres,—or for 2°.25 Fah., 25.25 metres,—or an increase of temperature of 8°.91 Fah., for every 100 metres; which agrees very well with the results found for Bogoslowsk.

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* This paper given in former Number of this Journal.

We may from this law calculate the temperature of the earth at Bogoslowsk, although we possess no direct observation; for, after the most diligent search, we found no spring fitted for the purpose. As we have here determined the temperature of the earth from that of springs whose temperature is almost uniform, and as this property is not found in all springs, but only in those which arise from a certain depth; so it is not properly the temperature of the level of the soil, of which we have been hitherto speaking, but that of a shaft, which is continued to a considerable, but very uniform, distance from the level of the earth. If we, therefore, wish to calculate the temperature of the earth from that of great depths, in the above sense, we must first of all determine at what depth the bed may be, from which rise the springs which possess a nearly uniform temperature throughout the whole year. This question cannot be answered with precision, yet this depth may be fixed at nearly 25 metres. This estimate does not appear too large; for, at Paris, the oscillations of the temperature of the earth do not quite cease at 28 metres; and it is probable, that, in high latitudes, where the maxima and minima are farther removed from one another than at Paris, the oscillations of the deeper points are as observable as was the case with the springs which were examined.

Deducting, now, 25 metres from the first station, 31 metres remain, as its depth below the bed, to which we have referred all the temperatures of the earth. But 31 metres give, according to the foregoing, 2°.7, as the difference of temperature. But as the temperature of the upper station was found to be 38°.07, the temperature of the soil at Bogoslowsk must be placed about 35°.37.

In Bogoslowsk, in some places, after hard winters, the soil at the end of summer is still frozen some feet below the surface. We see from this, that we are justified in referring the temperature of the earth to a deeper level, and that, in inconsiderable depths, the mean temperature of the year is very changeable, and may sink below 32°. When the oscillations of the earth's temperature are so great, that the formation of ice is possible, it may happen that the succeeding warmth is not able to melt it; and thus we easily explain the existence of ice on ground where the mean temperature is certainly above 32°.

Temperature of the Earth in Nishney-tagilsk (Lat. 58°), *and Werchoturie* (Lat. 59°).

These two places are situate, as well as Bogoslowsk, on the eastern declivity of the Urals, and are nearly 200 metres above the level of the sea. In Nishney-tagilsk, mine-water, found at a depth of 65 metres, had a temperature of 40°.77. Deducting here, again, 25 metres from the depth, and calculating the number of degrees which the temperature of the earth must decrease to this depth of 45 metres, we find 37°.17 for the temperature of the earth in Nishney-tagilsk. A well 5 metres deep indicated 37°.85: this temperature is somewhat too high (particularly as, from the above quoted observations, wells in a a high latitude ought to shew a lower temperature than springs), which is easily explained, from the observation having been made in autumn,—that is, at the time of the maximum of temperature of deep wells; and the well was not deep enough, to have a constant temperature.

The Werchoturie, an impetuous spring, had a temperature of 36°.72. Even this temperature is probably a little too high, as the observation was made in autumn. As the springs in Kasan, at that season, have a temperature 0°.45 higher than the mean, we may safely assume that the true mean temperature of the springs in Werchoturie was 36°.27.

Some experiments are here to be mentioned, which were performed in Kuschwa and Bogoslowsk, at the instance of Dr Erman, and with the assistance of the mining-officer, whose politeness, was truly exemplary, and which consisted in piercing into the earth with a borer to the depth of 20 feet, and observing the temperature at the deepest point. None of these experiments gave a decided result: they always met with water, which, collecting at the bottom of the bore, and coming from the surface, indicated a higher temperature. Perhaps, also, the borings were not deep enough, and the spots not happily selected. The temperature of this water was always about 41° and 42°.12, which was also that of most of the wells near the surface in that quarter. The boring in Kuschwa (Lat. 58°½), indicated 41°. A well there, whose surface was almost close under the surface of the ground, was 41°.56; a similar well in Nishney-turins (Lat. 58°¾), 41°.45; another in Nishney-tagilsk, 9 feet deep, 39°.42; a bore hole in Bogoslowsk, 42°.57; a reservoir of water, which was filled by a small spring, and whose level was very little under the surface of the earth, in the same place, 41°.

I may be permitted to quote an observation which Dr Erman communicated to me, and which may confirm the observations at Bogoslowsk. He found near Perm (Lat. 60°) the temperature of the mine-water, at 30 metres, = 36°.5, which gives 36°.05 for the depth of 25 metres. Perm lies nearly as high as Bogoslowsk, and besides farther west: the temperature of the earth there, must therefore be a little higher than that of Bogoslowsk.

Conclusions.

We see from the foregoing, that the temperature of the earth is sometimes very different from the mean temperature of the air, and its distribution follows different laws. Wahlenberg's observations have long ago shown (and the preceding confirm it), that the temperature of springs in high latitudes is higher than that of the air. Von Humboldt, and after him Von Buch, found the temperature of springs, in low latitudes, considerably lower than that of the air. We shall here give a comparative view of the principal of these observations, in which only those are used which are made at the level of the sea, or not much above 1500 feet above it. Observations on springs were preferred to those on wells. The greater part is extracted from Von Buch's Treatise on the Temperature of Springs, in Poggendorf's Annals, vol. xii. part 3. 1828, and also from Humboldt's Treatise on Isothermal Lines.

PLACES.	Latitude.	Height above Sea in metres.	Temp. of Earth, Fahr.	Temp. of Air, Fahr.	Observer.
Congo,	9° S.	45	72°.95	78°.12	Smith.
Cumana,	10¼ N.	0	78.12	82.40	Humboldt.
St Jago (Cape Verd Isles),	15	0	76.10	77.00	Hamilton.
Rockfort (Jamaica),	18	0	79.02	80.60	Hunter.
Havannah,	23	0	74.30	78.12	Ferrier.
Nepaul,	28	0?	73.85	77.00	Hamilton.
Teneriffe *,	28½	0	64.40	70.92	Buch.
Cairo,	30	0	72.5	72.5	Nouet.
Cincinnati,	39	160	54.27	53.82	Mansfield.
Philadelphia,	40	0	54.95	54.27	Warden.
Carmeaux †,	43	300?	55.40	57.87	Cordier.
Geneva,	46	350	52.02	49.32	Saussure.
Paris,	49	75	52.70	51.57	Bouvard.
Berlin,	52½	40	50.22	46.40	
Dublin,	53	0	49.32	49.10	Kirwan.
Kendal,	54	0	47.75	46.17	Dalton.
Keswick,	54½	0	48.65	47.97	
Konigsberg,	54½	0	46.62	43.25	Erman.
Edinburgh,	56	0	47.75	47.75	Playfair.
Carlscrona,	56¼	0	47.30	47.30	Wahlenberg.
Upsal,	60	0	43.70	42.12	...
Umeo,	64	0	37.17	33.35	...
Giwartenfiäll,	66	500	34.25	25.25	...

We may augment this Table by the observations made in Kasan and the Urals. For, where the temperature of the air is unknown to us, we will fix it by analogy, from which no great error can arise, as the places are so near each other. It is known, that, for middle latitudes, the diminution of temperature is 1°.125 for every degree. This is established by observations made near the points in question, namely, in Petersburg and Moscow. The difference of latitude between these two cities is 4°⅙; the mean temperature of the air at Petersburg, is 38°.75; of Moscow, 40°.1; the difference of the mean temperature is therefore 1°.35. As Moscow is nearly 300 metres higher than Petersburg, to this difference 2°.92 is to be added; we have therefore a decrease of nearly 4^c.5 for 4°.⅛ of latitude, or not quite 1°.12 for each degree of latitude.

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* As at a height of 1500 feet the temperature of springs in Teneriffe is almost the same, so might the temperature 64°.40 belong to a somewhat higher place (as often seems to be the case in mountainous districts), and therefore, if we reduce it to the level of the sea, an augmentation would be required.

† The mean temperature is estimated from the mean temperatures of Montauban, Toulouse, and Montpellier.

Therefore,

Place.	Latitude.	Elevation.	Temp. of Earth.	Temp. of Air.
Kisnekejewa *, .	54½°	300	39°.87	34°.7
Kasan, ...	56	30	43.25	37.4
Nishney-tagilsk,	58	200	37.17	31.55
Werchoturie, .	59	200	36.27	30.42
Bogoslowsk, . .	60	200	35.37	29.30

The first view of these tables shows that the temperature of the earth, in the same latitude, is different under different meridians; therefore, to obtain a clear view of the phenomenon, we must particularly class the observations according to the meridians in which they fall. The observations brought forward comprise four principal meridians, or rather meridional zones; that of Paris, of Umeo, of the Urals, and, lastly, of Cumana.

Besides, some of the stations mentioned have a considerable altitude above the sea; the temperature of their soil must therefore be reduced to its level. Unfortunately, we possess so few observations of this kind, that it is impossible to fix with exactness the diminution of the temperature of the earth with the altitude. We may, however, conclude from these observations, that the decrease of the temperature of springs is subject to nearly the same law as that of the air, and that, if any difference exists, the first decreases more slowly than the latter. We will, therefore, in round numbers, estimate 2°.25 for 250 metres. We then obtain for the temperature of the earth in Congo 77°; in Cincinnati, 55°.62; in Geneva, 55°.17; in Paris, 53°.37; in Giwartenfiäll, 38°.75; and in Carmeaux, 58°.1. Of the observations in the Urals, that of Kisnekejewa must be increased 2°.7, the rest 1°.8. The observations now obtain the following form, classed according to the meridians just mentioned.

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* The mean temperature of the air in Slatoust (Lat. 55°) is 1°.35. Kisnekejewa is half a degree more to the south, and 70 metres lower.

First Meridian of 0.			*Second Meridian of* 20° E.		
PLACE.	Latitude.	Temp. of Earth.	PLACE.	Latitude.	Temp. of Earth.
St Jago, . .	15° N.	76°.10	Cairo, . . .	30° N.	72°.5
Teneriffe, .	28½	64.40	Carlscrona, .	56½	47.3
Carmeaux, .	43	58.10	Upsal, ...	60	43.7
Geneva, . .	46	55.17	Umeo, . .	64	37.17
Paris, . . .	49	53.37	Giwartenfiäll,	66	38.75
Dublin, . .	53	49.32	Congo, . .	9 S.	77.0
Keswick, .	54½	48.67			
Edinburgh, .	56	47.75			
Third Meridian of 60° E.			*Fourth Meridian of* 80° W.		
Kisnekejewa,	54½	42.57	Cumana, . .	10	78.12
Nishney-tagilsk,	58	38.97	Rockfort, . .	18	79.02
Werchoturie,	59	38.07	Havannah, .	23	74.30
Bogoslowsk, .	60	37.17	Cincinnati, .	39	55.62
			Philadelphia,	40	54.95

We see from these examples,

1. That the temperature of the earth, as well as the mean temperature of the air, is not the same on the same parallel. If we draw lines through all the points which have the same terrestrial temperature, these *isogeothermal lines* resemble the isothermal, that they are parallel to the equator, but diverge from it in several points.

2. That the terrestrial temperature, as well as the mean temperature of the air, decreases with the increase of the latitude, but irregularly. The diminution of temperature from the equator to the poles, happens so much the quicker the nearer we approach the parallel of 45°. Beyond this, again, it decreases with less rapidity. By this we may explain, why, in low latitudes, it is less than the mean atmospheric temperature; for the latter decreases very little to Lat. 20°. The terrestrial temperature, therefore, which is continually decreasing, must, in these latitudes, be less, though, at the equator, it be as high as the mean of the air. In middle latitudes, again, the terrestrial temperature again equals the mean of the air, as it does not decrease so rapidly as the latter. In higher latitudes, for the same reason, the terrestrial temperature finally exceeds the atmospheric.

3. We may express the distribution of the terrestrial temperature, under the same meridian, pretty well by the following formula:

$$a - b \sin^2 l = t,$$

where a and b are constant, l the latitude, and t the terrestrial temperature.

Let us combine, in the first meridian, to find out the constant numbers, the observations of Paris and Edinburgh. We obtain,

$$a - b \sin^2 56° = 47°.75,$$

$$a - b \sin^2 49° = 53°.37;$$

from which

$$a = 79°.92, \quad b = 47°.02.$$

The following Table gives the comparison of the observed and calculated values:

Place.	Calculated.	Observed.
Equator, .	79°.92	
Teneriffe, .	69.12	64°.4
St Jago, .	76.77	76.1
Carmeaux, .	58.1	58.1
Geneva, .	55.4	55.17
Paris, . .	53.37	53.37
Dublin, . .	49.55	49.32
Keswick, .	48.65	48.65
Edinburgh,	47.75	47.75
Pole, . . .	32.90	

The observation at Teneriffe deviates very much; but this island lies very far west, and consequently not properly under the first meridian.

In like manner, for the second meridian, if we use only the observations of Cairo and Upsal,

$$a = 86°.9, \quad b = 57°.6.$$

These values give the following Table:

Place.	Calculated.	Observed.	Place.	Calculated.	Observed.
Equator, .	86°.9		Upsal, . .	43°.7	43°.7
Cairo, . .	72.5	72°.5	Umeo, . .	40.32	37.17
Berlin, . .	50.67	50.22	Giwartenfiäll,	38.75	38.75
Carlscrona,	47.07	47.3	Pole, . . .	29.30	

For the third meridian, we find, from the observations of Kiskenejewa and Bogoslowsk,

$$a = 83°.52, \quad b = 61°.87.$$

From which,

PLACE.	Calculated.	Observed.
Equator, . . .	83°.52	
Kisnekejewa, .	42.57	42°.57
Nishney-tagilsk,	38.97	38.97
Werchoturie, .	38.07	38.07
Bogoslowsk, .	37.17	37.17[*]
Pole, . . .	21.67	

Lastly, for the fourth meridian, from the observations of Rockfort and Philadelphia,

$$a = 86^\circ, \quad b = 75^\circ.82.$$

And from which,

PLACE.	Calculated.	Observed.
Equator, . .	86°.0	
Rochfort, . .	79.02	79°.02
Havannah, .	74.3	74.3
Cincinnati, .	55.62	55.62
Philadelphia,	54.95	54.95
Pole, . . .	10.18	

The result calculated for Cumana deviates very much from the observed; but as Cumana also lies considerably to the east, it is here like Teneriffe. The same is the case with Konigsberg, in the second meridian, whose terrestrial temperature is a whole degree less by observation than calculation. Here a local cause seems to lower the terrestrial as well as atmospheric temperature. In Konigsberg, the temperature of the air is 43°·25: in Mittau, almost 2° farther north, and more to the east, it is higher, viz. 44°.6, from very careful observations carried on by Professor Pauker of Mittau for four years. The observation of times, also, does not agree with the calculation.

From these formulæ we may easily find the terrestrial temperature for every degree of latitude, under one of the meridians for which the formulæ are calculated. It is easily seen, that we may readily find in these meridians the points in which a temperature of 42°.25, 54°.5, or 65°.75 will be found. Lines drawn through these points, are the isogeothermal lines which we have already noticed, and are represented in Plate IV. In fact, if we eliminate the latitude l from the equation

$$a - b \sin^2 l = t$$

we obtain, by the usual reductions,

$$\cos^2 l = 1 - 2 \frac{a-t}{b}.$$

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[*] Such a coincidence of the observed and calculated results is only to be ascribed to chance.

from which formula we can easily find the latitudes which correspond to certain temperatures. We thus find,

LATITUDE.

Temp.	In 1st Meridian, Long. 0° from Paris.	In 2d Meridian., Long. — 20° E.	In 3d Meridian, Long. — 60° E.	In 4th Meridian, Long. — 80° W.
32°.0		77° 30′	65° 52′	57° 32′
43.25	62° 2′	60 31	53 47	48 40
54.5	47 20	48 36	43 14	40 8
65.75	33 18	37 18	32 25	31 7
77.00	14 27	24 30	18 57	19 44

As the terrestrial temperature of Cumana and Teneriffe is considerably less than the points lying in the interior of South America and Africa, which are under the same parallel, so must the isogeothermal lines, in the ocean between Africa and America, have a considerable inflexion to the south.

I have endeavoured to establish the terrestrial temperature at the surface of the earth (or rather at a depth of 25 metres) as a general law of nature, and have not, as has hitherto been done, deduced it from the mean temperature of the air, with the consideration of local circumstances. Von Buch, in the above treatise, has endeavoured to render it probable, that the differences between the terrestrial temperature and the mean of the air are produced by the cooling or warming of the lower strata, by the surface-water sinking downwards *. Although this may certainly have some influence on the terrestrial temperature, yet many observations are opposed to its admission. It is not shewn, that the system of subterranean waters to which the springs belong, stands in any immediate connection with the atmospheric water; and rain sinks but to a small depth into the earth, particularly if it is composed of rock, and is chiefly expended in the process of vegetation, or evaporated, or collected into running waters. In Bogoslowsk, where, for the greater part of the year, the ground is covered with snow, and consequently no water can sink down; yet in mine-works the quantity of water is not greater in summer and autumn than in winter, and only augments in spring, when the pressure of the atmospheric water is considerable, from the sudden melting of the snows, and the swelling of the rivers. In high latitudes, where the springs almost throughout

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* Vide Remarks on Temperature of Springs, by Von Buch, p. 166, vol. vi. of the Edin. New Phil. Journ.

the whole year, break forth from under a covering of snow, how can the small quantity of water, which, in summer, by the melting of the snow and fall of rain, sinks into the earth, elevate the temperature of the subterranean water so many degrees for the whole year?

In some places, such as marshes, the mixing of atmospheric water with that of springs is evident; also loose sands, such as those of the Egyptian deserts, heated by the sun's rays, elevate the temperature of springs *; but such observations have been excluded in the above calculations.

However well the formula $a - b \sin^2 l = t$ expresses the observations, yet it must not be forgotten that it is only an approximative formula, and that it may give false results for points far removed from the places of observation. To such places belongs the pole, for which all the four equations must give the same value, but which is not the case. It may be admitted, that, in the vicinity of the pole, the terrestrial temperature is at its minimum, which this formula cannot indicate, as, at $l = 0$ it has its greatest value, at $l = 90°$ its smallest. As the isogeothermal line of 32° under the first meridian, approaches very near the pole, if we can trust the formula even reaches it, so that the space, which is included by the isogeothermal line of 32°, has a considerable indentation, and seems almost to form two portions, the middle points of which are to be viewed as two distinct poles of cold. One of these points probably lies in North America, the other in the north of Siberia. Unfortunately we still want observations on these places. The temperature under these poles of cold cannot be much under 32°.

With respect to the temperature at the equator, we see that these points which are on coasts washed by the sea, or on islands, have a lower temperature than those which are in the middle of a great continent. The warmest point of the equator is in the interior of Africa; to the north of this point, at least in latitudes which do not exceed 50°, the isogeothermal lines have a considerable curve to the north. That point, which, in the ocean included between great continents, falls in 60° east longitude, has even a temperature of 3·37 lower. Those points, finally, which lie next to the observations made on the west coast of Africa (Teneriffe) and east coast of America (Cuma-

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* Well at the great Pyramid 88·25.

na)* possess almost the same low temperature, so that we may conjecture, that the coldest point of the equator between 80° west and 60° east longitude, is, in the great ocean between the west coast of Africa and the east coast of America; but, from thence the terrestrial temperature increases rapidly to the east and west. The same holds for the calculated temperatures of the equator which, we have already observed of the pole, that the formulæ are perhaps not quite conformable to one another. It is difficult to conjecture what can have produced a greater terrestrial temperature in the low latitudes of the second meridian. The circumstance of the equator in Africa, extending through a large extent of country covered with sandy wastes, may be a cause of the phenomenon; but it is difficult to conjecture how this could influence high latitudes. If we reflect that there are, under this meridian, two active volcanoes (Vesuvius and Etna); that Germany is studded with basalt and other igneous rocks; that a greater or less number of warm springs testify the high temperature of the interior; that, finally, in the Tyrolese Alps, porphyry and augite-rock predominate, to which, according to the new views, these immense masses owe their elevation; it is natural to be expected, that even this circumstance of melted igneous masses being found at a small depth under the surface of the whole district, may be connected with the higher temperature of the soil.

South of the equator we possess but one observation, that of Congo, under the second meridian; and if a single observation can justify us in forming any conclusion, it explains how the warmest isogeothermal line (or the isogeothermal equator) does not coincide with the equator of the earth. We require only, in the map, Plate IV., to halve the distance between the isogeothermal line of 77·0 and the point in Congo, where the terrestrial temperature is also 77°, to find a point through which the isogeothermal equator must pass. If this line, as is probable, runs parallel to the isogeothermal line of 77°, then is the temperature on it greater under the first meridian, less under the second, and likewise less under the third and fourth, than the calculated temperature for the equator of the earth; the temperatures are therefore distributed similarly on the isogeothermal equator, as they would be if this line coincided with the terrestrial equator, and deviate little from 81·5; that is, the mean temperature of the air in these regions.

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* Combining the observations at Philadelphia and Cumana, we find only 79·92 for the temperature at the equator.

The temperature of the earth stands in manifest connexion with other appearances exhibited by nature. I will here only mention some of these, to show how fruitful these considerations may in time become. Wahlenberg has already shewn, that in high latitudes many perennial deep-rooted herbs, trees and shrubs, only thrive, because the temperature of the earth exceeds the mean temperature of the air. In these latitudes, the periods of vegetation appear to be as much regulated by the periods in the temperature of the earth as that of the mean temperature of the air; a remark which I had often an opportunity of making, on my journey to the northern Urals. In Middle Russia, the vegetation commences later than in Germany, but the harvest falls at the same time, in the month of July; but if, proceeding northwards, we pass the point where the mean temperature of the air is 32·0, the harvests become later, and happen in August; and, finally, before the cultivation of grain is completely at an end, in the beginning of September; this period, which corresponds with the maximum of the atmospherical temperature, approaches, therefore, in high latitudes, the time when the terrestrial temperature is highest. The connexion which the direction of the northernmost isogeothermal lines appears to maintain with the boundary of the polar ices, also merits our attention. These limits are laid down on the accompanying chart, from Scoresby's interesting paper on the Polar Ice*. The first glance at the chart informs us, that the isogeothermal line of 32° extends somewhat to the south of the boundary of the ice, except at Greenland: but of this country we know that formerly it was not so much beset with ice as at present. The terrestrial temperature can only operate on masses of ice, which sink to a considerable depth, which is not the case with those on the Continent; and hence the effect of a large mass of land, such as Greenland, on the polar ice boundary is easily explained. The floating-off the ice on the east coast of Greenland towards the south-west, which Scoresby has so well observed, would intimate colder points in the north of America, particularly of Greenland; at least, I do not know how we can otherwise explain this appearance, so much at variance with our ideas of the distribution of temperatures in the surface of the earth. It is clear, that, if the coldest point of the polar sea is just under the pole, the colder water must move below from north to south, and the warmer on the surface from south to north, the first of these currents would be changed by the rotation of the earth into a south-west, the second into a north-east one; as it must be the surface-water which affects the floating of the ice, it must take place towards the north-east, viz. in the opposite direction, to what really happens. But, if the coldest point is some distance south from the pole, then the surface-current must take a southerly direction, or rather a south-west, on account of the rotation of the earth.

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* This remarkable memoir first appeared in the 2d volume of the Memoirs of the Wernerian Society.

I believe, that, in future, we will find more connexion between the phenomena of currents and the distribution of the earth's temperature; but the latter may exert some influence on the distribution of the intensity of the earth's magnetism. I have, in a former treatise, endeavoured to establish the probability of the magnetism of the earth being seated at its surface; if this is the case, then certainly the distribution of the earth's temperature must influence that of the magnetic intensity. But we have here the choice of two hypotheses, either the earth is to be regarded as a magnet itself, and then the intensity of its magnetic power decreases with the increase of temperature, or it receives its power from without, and is, as it were, a mass of soft iron, which is rendered magnetic by a foreign body, and then its magnetic force increases with the heat.

Although the first of these hypotheses has been that hitherto universally received, yet the second gains some probability from the newly discovered magnetic influence of the sun's rays, and the dependence of the daily changes of the declination on the course of the sun. We will immediately see, that the knowledge we have obtained of the distribution of the earth's temperature gives us a means of deciding the question with greater certainty.

Let us suppose, first, the globe of the earth as a heated mass, extremely capable of magnetism, and whose surface has almost a uniform temperature, to be rendered magnetic by the power of a distant heavenly body (the sun). It is clear, that the distribution of the magnet will only, in such a body, shew a great regularity, and the lines of equal inclination will correspond with those of equal intensity. But if, by degrees, differences in the surface temperature arise, it is clear that the lines of equal intensity in particular will change, and will remove in some points from those of equal inclination. If a line of equal inclination passes through several points, which have the same terrestrial temperature, then, in all these points, the intensity of the magnetic force will also be the same; but in all points of the same line, where the terrestrial temperature is higher or lower, will the intensity be greater or less (if the second hypothesis be correct). This appears really to be the case; and if future observations increase the number of those already collected, we may consider this circumstance as a powerful confirmation of the second hypothesis.

From Hansteen's chart (of the lines of inclination and isodynamic lines for the whole magnetic power for 1825, also from the chart of isodynamic lines, which is appended to his Treatise in Poggendorf's Annals, v. 9.), we see that the inclination and isodynamic lines in Scotland run nearly parallel; but in the east, in Norway and Sweden, the latter deviate to the north, and intersect the former: On the line of equal inclination, therefore, in the east, the intensity is less than in the west, which is also the case with the terrestrial temperature. Edinburgh has nearly the same inclination as Stockholm; in Edinburgh the intensity is 1·400, the terrestrial temperature 47·75; in Stockholm, the first 1·386, the other 43·7. The same is the case with Paris and Kasan, whose inclinations differ little from one another; in Paris the intensity is 1·348, the terrestrial temperature 52·7; in Kasan, the former 1·320, the latter 43·25. Further, in Teneriffe and Naples: in Teneriffe the intensity = 1·298, terrestrial temperature 64·62; in Naples, the former 1·275, the latter about 61·25.

We now easily see why the pole of intensity falls to the south of the pole of inclination. As the temperature of the earth decreases to the north, so the lines of equal inclination lying nearest the pole of inclination, go to the north of it through colder points than to the south; but in these colder points, from the above principles, the intensity must be less than in the warmer; we must therefore seek for the pole of intensities, viz. the point where the intensities reach their maximum, to the south of the pole of inclination,—where it is really found, according to the newest observations calculated by Hansteen. The pole of intensity lies under Latitude 56°, Longitude 80°; and of inclination under Latitude 71°, Longitude 102° west from Paris.—*Poggendorf's Annalen*, 1829.

On peculiar Noises occasionally heard in particular Districts, with some further Remarks on the production of these Sounds. Communicated by the Author.

In page 74. of your last Journal, an interesting paper is inserted upon the peculiar noises heard at Nakuh, on Mount Sinai, resembling the tone of an Æolian harp, or the sound emitted by the instrument used in the Greek monasteries instead of a bell; that this is succeeded by a murmuring like that of a hollow top; and, lastly, becomes so loud that the earth seems to shake. In discussing the opinions of Mr Seetzen, Mr Gray, and other travellers, it is finally decided, on the evidence of Professor Ehrenberg, that the phenomenon is referable solely to the rolling or grating of dry coarse granular sand down the surface of a steep acclivity in the rock. Those who are conversant with alpine scenery, and in the habit of strolling amidst the recesses of these mountainous regions, will readily bear their testimony to the power of avalanches for the production of those awful concussions which so often rouse attention, re-echoing from every pinnacle and precipice; while, to the more gradual and gentle lapses of sheets of pulverised snow down the smooth inclined planes of lengthened acclivities, may be referred the minor meanings which rise and fall upon the ear, much resembling in character the tones of El Nakuh. But however just may be the deductions formed from the visit of Professor Ehrenberg to that remarkable place, I am induced to notice the subject, for the purpose of pointing out, not only the possibility; but the certainty, that similar effects may be produced by other causes, and that the murmurings of El Nakuh are by no means confined to the bosom of Mount Sinai. For I suspect that not only all elevated regions, but other tracts of land under favourably exciting circumstances, become, more frequently than our philosophy dreameth of, instruments on which Nature delights to play "sounds and sweet airs." That hills and plains, the wilderness and the waters, are in her hands but as "harps whose chords elude the sight;" though, whether this melody be of "the air or the earth," must remain a matter of mystery, whereupon wisdom yet may ponder. I shall proceed to corroborate my views by a few instances. It is observed by the author of one of the most delightful minor works* of modern date, that the "purely rural, little noticed, and, indeed, local occurrence, called by the country people Hummings in the air, is annually to be heard in one or two fields near his dwelling. "About the middle of the day, perhaps from twelve o'clock till two, on a few calm sultry days in July," he says, "we occasionally hear, when in particular places, the humming of apparently a large swarm of bees. It is generally in some spacious open spot that this murmuring first arrests our attention. As we move onward, the sound becomes fainter, and by degrees is no longer audible. That this sound proceeds from a collection of bees, or some such insects high in the air, there can be no doubt; yet the musicians are invisible. At these times a solitary insect or so may be observed here and there, occupied in its usual employ; but this creature takes no part in our aërial orchestra."

Now, before entirely acquiescing in an opinion thus delivered in the language of certainty, it should be remarked, in the *first* place, That the writer mentions the fact as *local* and *partial*, heard only in *one* or *two fields*, at *particular times of the year*, when the *air is in a certain state*, viz. *calm* and *sultry*. In the *next* place, it may, for good reasons, be fairly doubted, whether it really is produced by insects "high in air;" for it so happens, that, in the bosom of a thick wood, where there is a space partially opened, though still a very narrow and confined spot, in days precisely such as he describes them, *i. e.* sultry, and in the middle of summer, when the air is calm, I have often paused, to listen to a similar aërial humming, appearing to result from some unseen power close at hand, which for several years I hesitated not to attribute to insects, an opinion I felt compelled, though reluctantly, to give up, since, after the most diligent search, I could never detect the presence of any collected body sufficiently numerous to account for the effect. Many of the properties of sound have hitherto eluded the powers of science, and much that is mysterious still remains to be unravelled.

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* Journal of a Naturalist, p. 369, 2d edit.

With respect to the celebrated statue of Memnon at Thebes, we have some very obstinate authorities to contend with, before it can be given up as entirely and absolutely fictitious. Strabo, for instance, positively affirms that he heard sounds emitted; and so far was he from being a credulous auditor, that, without being able, as he says, to declare whether it proceeded from the statue or the base, he adds, that, although it did certainly appear to him to issue from the one or the other, he would rather believe that it came from the bystanders, and was altogether an imposture, than conclude, though supported by the evidence of his own senses, that stones ranged in such and such a manner were capable of yielding sound. Pausanias, also, who saw the mutilated remnants of the statue when the lower part alone remained on the pedestal, speaks of it as a fact concerning which there could be no question. Pliny, in his Natural History, book 36. ch. 7., in enumerating the various Egyptian marbles, mentions this Memnonian block as possessing the singular quality of cleaving or cracking under the influence of the morning sun. Juvenal alludes to it in his 15th Sat. l. 5,

> " Dimidio magicæ resonant ubi Memnone chordæ."

And Tacitus, finally, informs us, An. lib. 2. § 61., that Germanicus, in his progress up the River Nile, actually saw this " Memnonis saxea effigies, ubi radiis solis icta est, vocalem sonum reddens." Notwithstanding this collected evidence, though we may hesitate in admitting the fact to its full extent, I am inclined so far to give it weight, as to believe that, if there was imposture, that imposture had still truth for its foundation, namely, that some similar phenomenon had been detected in masses of insulated stones,—a supposition strongly corroborated by the unquestionable testimony of Humboldt, whose attention was drawn to some remarkable granite rocks in South America, which spontaneously, at certain times, emitted sounds much resembling those attributed to the colossal statue of Memnon, a circumstance well known to the natives, who, however, were at a loss for an explanation of the cause.

This distinguished traveller says, in the 4th volume of his Personal Narrative, that, according to credible witnesses, subterraneous sounds, like those of an organ, are heard towards sunrise, by those who sleep upon the granite rocks on the banks of the Oroonoko. He adds, that MM. Jomard, Jollois, and Devilliers heard, at sunrise, in a monument of granite, placed at the centre of the spot on which the palace of Karnak stands, a noise resembling the breaking of a string *.

The reflective powers of surfaces, whether inclined or horizontal, and the transmitting capacity of the air, afford data for every variety of theory, in the equally unaccountable and singular instances on record; and I believe that many of your readers, at all in the habit of paying attention to the numberless phenomena presenting themselves, will bear testimony to having heard strange sounds, whence and wherefore they knew not. He who has been called upon to keep watch during the lone hours and stillness of a calm night, will occasionally hear low murmurings rising and falling on the ear, for which he would find it difficult to account on any other theory than vibrations of air acting in some particular manner on intervening surfaces or projections.

It may be urged, and it is perfectly just, that the intensity of sound is very considerably increased during the night, which has been ascribed by Humboldt to the presence of the sun acting on the propagation and intensity of sounds, by opposing them with currents of air of different density, and partial undulations of the atmosphere, caused by unequally heating different parts of the earth. In these cases, the vibrations of sound

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* Analogous, and corroborative in some degree of these facts, is the following beautiful, though somewhat fanciful, passage of Madame de Stael's: "Et l'on meme que sur les côtes de l'Asie, où l'atmosphere est plus pur, on entend quelquefois le soir une harmonie plaintive et douce, que la nature semble adresser à l'homme, à fin de lui apprendre qu'elle respire, qu'elle aime, et qu'elle souffre."

are divided into two waves, where the medium suddenly changes, and a sort of acoustic mirage is produced, arising from the want of homogeneity of the air, in the same manner as a luminous mirage takes place from an analogous cause *. But, admitting the ingenious explanation of this scientific traveller, other causes possibly, however, and probably connected with the presence or absence, excess or diminution, of solar heat, may be operative in both the increase, and protracted continuity of sound. Thus, Captain Sir Edward Parry, during the intense cold experienced in Winter Harbour, was surprised at the great distance at which the human voice could be heard: "I have," he says, "often heard people distinctly conversing in a common tone of voice, at the distance of a mile, and to-day I heard a man singing to himself as he walked along the beach at even a greater distance than this." The strong tendency of sound to ascend, again, has great effect. Humboldt remarks the barking of a dog has been heard when the listener was at an elevation of about three miles in an aerostatic balloon. And it has been remarked, that, from the edge of the Table Mountain, which is 3600 feet high, and the upper part of which rises perpendicularly at the distance of about a mile from Cape Town, every noise made below, even to the word of command on the parade, may be distinctly heard.

The conducting power of water is well known, but to what extent would scarcely be credited, had we not the most undoubted evidence at hand, that of the much to be lamented Dr Clarke, whose words we shall give. "A remarkable circumstance occurred, which may convey notions of the propagation of sound over water, greater than will perhaps be credited; but we can appeal to the testimony of those who were witnesses of the fact, for the truth of that which we now relate. By our observation of latitude, we were 100 miles from the Egyptian coast; the sea was perfectly *calm, with little or no swell, and scarcely a breath of air stirring*, when the Captain called our attention to the sound, as of distant artillery, vibrating in a low gentle murmur, upon the water, and distinctly heard at intervals during the whole day. He said it was caused by an engagement at sea, and believed the enemy had attacked our fleet at Alexandria. No such event had, however, taken place, and it was afterwards known, that the sounds we then heard proceeded from an attack, made by our troops, against the fortress of Rachmanie on the Nile, beyond Rosetta. This had commenced upon that day; and hence alone the noise of guns could have originated. The distance of Rachmanie from the coast in a direct line, is about ten leagues; this allows 130 miles for the space through which the sound had been propagated when it reached our ears*."

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* Ann. de Chim. vol. xii. p. 162; also this Journal, old series, vol. iii. p. 194.

Of the conducting and reverberating powers of a flat surface, I would mention, not only from its extreme singularity, but its classical position, the echo in the Gardens of Les Rochers, once the well known residence of Madame de Sevigné. An additional reason for noticing it is, because I doubt whether its existence is sufficiently known, or was duly appreciated, even in the days of its celebrated guardian, since we find her alluding to it only as a "petit rediseur," repeating "mot à mot jusque dans l'oreille;" and gladly would I induce any scientific traveller to include within his tour through this picturesque part of France, a visit to a place and object so well worthy of his attention. The Chateau des Rochers, sold unfortunately in the Revolutionary times, and (I speak of a few years ago) in the hands of a most unworthy and disreputable owner, is situated no great distance from the interesting and ancient town of Vitré. A broad gravel walk on a dead flat, leads through the garden to the house. In the centre of this, on a particular spot, the listener is placed, at the distance of about ten or a dozen yards from another person, who, similarly placed, addresses him in a low, and, in the common acceptation of the term, inaudible whisper, when

"Lo, what myriads rise!"

for immediately from thousands and ten of thousands of invisible tongues, starting from the earth beneath, or as if every pebble was gifted with powers of speech, the sentence is repeated with a slight hissing sound, not unlike the whirling of small shot passing through the air. On removing from this spot, however trifling the distance, the intensity of the repetition is sensibly diminished, and within a few feet ceases to be heard. Under the idea that the ground was hollow beneath, the soil has been dug up to a considerable depth, but without discovering any clew to the solution of the mystery. On looking round for any external cause, I felt inclined to attribute the phenomenon to the reflecting powers of a semicircular low garden-wall, a few yards in the rear of the listener, and in front of the speaker, although there was no apparent connexion between the transmission of sound from the gravel-walk and this wall. The gardener, however, to whom I suggested this, assured me that I was wrong, since within his memory the wall had been taken down and rebuilt, and that in the interim there was no perceptible alteration in the unaccountable evolution of these singular sounds.

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* Clarke's Travels, vol. iii. p. 331.

On the smooth surface of ice, and on a much larger scale, a somewhat similar effect has been observed. For an instance, I shall refer to the animated account extracted from Head's Forest Scenes, a little work scarcely, if at all, inferior to the spirited rough notes of his brother of galloping notoriety. "*March* 7.—The frost continued, and the cold increased to a very low temperature, the effect of which upon the extended sheet of ice which covered the bay, was somewhat remarkable. It cracked and split from one end to the other, with a noise which might have been mistaken for distant artillery; but this, when it is taken into consideration that the sheet of ice was 15 or 16 square miles in area, and 3 feet thick, may be easily imagined. Nor was this all: I was occasionally surprised by sounds produced by the wind, indescribably awful and grand. Whether the vast sheet of ice was made to vibrate and bellow like the copper which generates the thunder of the stage, or whether the air rushing through its cracks and fissures made a noise, I will not pretend to say; still less to describe the various intonations, which in every direction struck upon the ear. A dreary undulating sound wandered from point to point, perplexing the mind to imagine whence it came, or whither it went, and whether aërial or subterranean, sometimes like low moaning, and then swelling into a deep-toned note, as produced by some Æolian instrument, it being in real fact, and without metaphor the voice of winds imprisoned in the bosom of the deep. This night, March 7., I listened for the first time to what was then perfectly new to me, although I experienced its repetition on many subsequent occasions, whenever the temperature fell very suddenly *."

In this case, as well as in that mentioned by Sir Edward Parry, it should be remarked that temperature was closely connected with the sounds, a proof that the peculiar state of the air, with respect to its radiating powers of heat, is an important feature in causing these phenomena, and so far at least may be adduced in support of even the morning music of Memnon's statue, when the sudden action of the solar rays might produce incalculable effects, darting on certain substances, surrounded with a temperature considerably cooled down by dews, and the chill of the night air.

I shall conclude by mentioning two other causes, bearing perhaps more closely on the original question, which, like the echo of Les Rochers, have fallen under my own immediate observation.

In the autumn of 1828, when on a tour through Les Hautes Pyrenées, I formed one of a party, quitting Bagneses de Luchon at midnight, with an intention of reaching the heights of the Porte de Venasque, one of the wildest and most romantic boundaries between the French and Spanish frontier, from the summit of which the spectator looks at once upon the inaccessible ridges of the Maladetta, the most lofty point of the Pyrenean range. After winding our way through the deep woods and ravines, constantly ascending above the valley of Luchon, we gained the Hospice about two in the morning, and, after remaining there a short time, proceeded with the first blush of dawn to encounter the very steep gorge terminating in the pass itself, a narrow vertical fissure through a massive wall of perpendicular rock. It is not my intention to detail the features of the magnificent scene which burst upon our view as we emerged from this splendid portal, and stood upon Spanish ground,—neither to describe the feelings of awe which rivetted us to the spot, as we gazed, in speechless admiration, on the lone, desolate, and (if the term may be applied to a mountain), the ghastly form of the appropriately-named *Maladetta*. I allude to it solely for the purpose of observing, that we were most forcibly struck with a dull, low, moaning, Æolian sound, which alone broke upon the deathly silence, evidently proceeding from the body of this mighty mass, though we in vain attempted to connect it with any particular spot, or assign an adequate cause for these solemn strains. The air was perfectly calm. The sky was cloudless, and the atmosphere clear to that extraordinary degree conceivable only by those who are familiar with the elevated regions of southern climates. So clear and pure indeed, that, at noon, a bright star which had attracted our notice throughout the grey of the morning, still remained visible in the zenith. By the naked eye, therefore, and still more with the assistance of a telescope, any water-falls of sufficient magnitude would have been distinguishable on a front base, and exposed before us; but not a stream was to be detected, and the bed of what gave evident tokens of being occasionally a strong torrent, intersecting the valley at its foot, was then nearly dry. I will not presume to assert, that the sun's rays, though at the moment impinging in all their glory on every point and peak of the snowy heights, had any share in vibrating these mountain chords; but on a subsequent visit, a few days afterwards, when I went alone to explore this wild scenery, and at the same hour stood on the same spot, I listened in vain for the moaning sounds; the air was equally calm; but the sun was hidden by clouds, and a cap of dense mist hung over the greater portion of the mountain.

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* Head's Forest Scenes, p. 204.

My remaining instance in point is nearer home, and though by no means of common occurrence, is sufficiently frequent to be pretty generally known in its own immediate neighbourhood. On turning to a map of Cheshire, it will be seen, that, from within a short distance eastward of Macclesfield, a range of hills extends in an irregular curve to the north-west, forming a sort of concave screen, somewhat abruptly terminating over the comparatively level plains of this part of the county. In different parts of these, as well as in more elevated spots, at the various distances of from four to six miles or more, at certain seasons of the year, usually in the early part of spring, when the wind is easterly, and nearly calm on the flats, a hollow moaning sound is heard, familiarly termed the "soughing of the wind," and evidently proceeding from this elevated range, which, I should add, is intersected with numberless ravines or valleys; and I have no doubt, that when the atmosphere is in that precise state best adapted for receiving and transmitting undulations of air, a breeze, not perceptible in the flat country, gently sweeps from the summits of the hills, and acts the part of a blower on the sinuosities and hollows or cloughs as they are called, which thus respond to the draught of air like enormous organ-pipes, and become for the time wind-instruments on a gigantic scale, producing those striking and melancholy modulations so well expressed by the provincial word "soughing," derived, no doubt, from the old Welsh substantive "suad," a lullaby, or the verb "suaw," to hush, to lull, to rest; or, as Sir Walter Scott in his glossary interprets it, a hollow blast or whisper, in which sense he uses it. "Hist,' exclaimed Mucklewrath*, 'I hear a distant noise.' 'It is the rushing of the brook over the pebbles' said one. 'It is the *sough* of the wind among the bracken' said another." And, again, when old Dousterswivel† is keeping his midnight vigils near goot Maister Mishdigoat's grave, the "melancholy *sough*" of the dying wind is fitly associated with "strains of vocal music, so sad and solemn, as if the departed spirits of the churchmen who had once inhabited those deserted ruins, were mourning the solitude and desolation to which their hallowed precincts had been abandoned."

E. S.

On the Geographical Characters and Geognostical Constitution of Spain. By Professor HAUSMANN, of Göttingen. Communicated by the Author ‡.

Geographic Features of the Country.

THE chief direction of the Pyrenean chain, properly so called, is from ESE to WSW. It is disposed, not in one but in two chains, which run parallel to each other. An erroneous view has been taken up and propagated by many of the newer geographers, viz. that the principal mountain groups in Spain are mere continuations of the Pyrenees: they have assumed and delineated in maps what they call an Iberian Mountain Chain, which chain is said to arise in the west, in the mountains of Asturias, at the sources of the Ebro, from thence to run in a south-eastern direction towards the frontiers of Arragon and Old Castile, where it assumes a southerly direction, and ranges downwards to Cabo de Gata, where it terminates. It is conceived that the other principal chains of mountains are lateral branches of that Iberian mountain chain, and that they thus form not longitudinal valleys, but transverse valleys. This error has arisen from a series of heights which range through Spain, in the direction of the supposed chain, forming the principal *water-shed* (divortia aquarum) between the Atlantic and Mediterranean Seas, and which, therefore, in regard to the surface of the Iberian peninsula, is of great importance, because there is connected with it the striking phenomenon, that, with exception of the Ebro, all the considerable rivers flow towards the Atlantic Sea, and that the eastern acclivity is short, while the western and south-western are long. But this series of heights (höhenzug), has not the characters of a connected mountain chain (group), although single mountain masses are found in its line of direction. Among these, the most distinguished are the *Sierras de Molina, de Albaracin, de Cuenca,* on the borders of Arragon and Old and New Castile. Not only the external aspect, but also the internal composition, go to prove that the principal mountain chains of Spain are not members of a great mountain system, or system of mountains. The principal mountain chains which traverse the interior of Spain, have the same general direction, which is from WSW. to ENE.

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* Old Mortality, vol. iv. p. 85. † Antiquary, vol. ii. p. 265.

‡ As we know but comparatively little of the geographical and geological features of Spain, we have much pleasure in laying before our readers these observations of Professor Hausmann, abstracted from a memoir lately read before the Royal Society of Gottingen, by that distinguished naturalist, but not yet printed or published.—EDIT.

The most northern chain begins at the western frontier of Arragon, and forms, under the name Somosierra and Guadarrama mountains, the boundary between Old and New Castile, and continues, under the names Sierra del Pico, Montana de Griegos, Sierra de Gata, and at length unites with the Portuguese Sierra de Estrella. This very striking mountain chain, which is so much distinguished by its form and height, is much less connected in its longitudinal direction than the chain of the Pyrenees. The eastern part of it, whose majestic pyramidic summits are seen from the high table land of Madrid, rises 7700 feet above the level of the sea. Another mountain chain ranges between the Tagus and the Guadiana, under the names *Montes de Consuegra*, *Sierra de Yevenes*, *Montanas de Toledo*, *Sierra de Guadelupe*, and continues onwards to Portugal. A more simple chain than this is the moderately high *Sierra Morena*, which, beginning on the eastern boundary of Mancha, continues onward between the Guadiana and the Guadalquiver. Its northern foot is much higher than its southern. We rise gradually to the road which leads from Madrid towards Andalusia, to a pass 2255 feet above the level of the sea. The acclivity is steeper on the south side.

The most southern chain of mountains, which, in its direction, corresponds to the south coast of Spain, or rather ranges along in the direction of the coast, is distinguished by its form and height. Both in its exterior and interior, it is more complicated in its structure than the other Spanish ranges of mountains, because there are in it many high ridges which run parallel, and thus longitudinal valleys are formed. This mountain range has not an uninterrupted course; on the contrary, the eastern part of it, whose principal mountain ridge is named Sierra Nevada, is separated from the western, named the Sierra de Ronda. The first, the Sierra Nevada, is particularly distinguished by its extent and height. Its principal mountain ridge overtops the highest summits of the Pyrenees; for, according to the measurements of Dom. Simon Rojas Clementi, the highest summit, Cumbre de Mulhacen, is 11,105 feet above the level of the sea; hence, notwithstanding its southern situation, it rises above the snow line, which there attains a height of 8600 feet above the sea. The northern foot of the Sierra Nevada is bounded partly by the table land of Guadiz and Granada, of which the latter is 2000 feet above the sea. The southern acclivity of the ridge which runs parallel with the central chain, sinks, on the contrary, very rapidly into the sea. The most easterly of these is the Sierra de Aljamilla; then follows the Sierra de Gador, rich in ores; and to these the Contraviesa, the Sierra de Lujar, and the Sierra de las Almijaras. These ridges do not form an uninterrupted series; on the contrary, are separated from each other by transverse valleys. In the continuation of this coast chain, we have, to the south-west of Malaga, the Sierra de Mijas and the Sierra Bermeja, which range towards the Sierra de Ronda, which extend their arms towards the most southern extremity of Spain.

When we take a general view of these different principal mountain chains of Spain, and at the same time attend to the prolongation of the middle ones into Portugal, it follows, that the more southerly they are, the shorter is their course. It further appears, that there is connected with this a southerly curvature of the extreme branches; with these is connected the turning of the rivers from their principal direction as they approach to the sea. This is least considerable with the Tagus, but most considerable with the Guadiana and Guadalquiver. These rivers do not break across the mountain chains, as is the case with the smaller streams which belong to the Sierra Nevada, in order to reach the sea by the shortest course: on the contrary, they continue true to the course of the accompanying mountain chains to their estuary. As the general figure of the Iberian Peninsula is explained from the relations of its chains of mountains, in the same way, but in a more striking manner, can be explained the south coast of Spain, from Gibraltar to Cabo de Gata.

Besides the principal mountain chains already mentioned, there are many others of lesser extent and elevation, which do not belong to these. Many of these have an effect on the formation of those situated on the eastern acclivity of the Iberian peninsula, on the figure of the sea-coast, and on the rivers that flow on this coast into the Mediterranean. Amongst these mountain masses, the most considerable is that which rises south from the Ebro, on the borders of Arragon, and Old and New Castile, and the kingdom of Valentia, and which consists of many ridges that run in different directions. The mountains of Jaen, which separate the Valley of the Guadalquiver from the high table land of Granada, is very striking.

Spain is distinguished not only by the great number of its considerable mountain masses, but also by its lofty *table lands*, which extend between the ranges of mountains, forming a striking contrast with the perpendicular or mural precipices which shoot up from them, and also occasion a great uniformity in the nature of Spain, as it brings the climate of a great part of this country to that of a higher latitude. The whole middle part of Spain from the Ebro to the Sierra Morena, and from the frontiers of Portugal to the high mountain range which forms the water-shed between the Atlantic Ocean and the Mediterranean Sea, is formed by them into a widely extended table-land, of which the different plains, separated from each other by ranges of mountains, are from 2000 to 2500 feet above the level of the sea; but, in regard to it, we have to remark, that the table land of Old Castile in general occupies rather a higher level than that of New Castile. The southern part of Spain also possesses single table lands, which, however, have neither the extent nor the connection of those situated in the middle of the peninsula.

Geognostical Structure.

The principal mountain chains differ not only in their external aspect, but also in their internal composition: they appear more as different individuals than as members of a single system. They have this in common with one another, that their nucleus consists, in whole or in part, of *primitive* and *transition rocks*; but not only the species, but also the relations of these, vary in the different chains. A great body of granite, which seldom reaches the highest points of the country, and contains subordinate beds of gneiss and other primitive rocks, ranges through the Pyrenees properly so called. It is surrounded by a predominating mass of crystalline slate and of transition rocks, among which the most abundant are clay-slate and limestone. On the contrary, on the western continuation, in the Biscayan mountains, the older rocks are not widely distributed, and appear first in Gallicia, at the western extremity of the northern mountain chain, where, according to Humboldt, granite accompanied by crystalline slates appear again, and in great extent. The principal mass of the mountain chain which separates Old from New Castile is composed of gneiss and granite. In the chain of mountains extended between the Tagus and the Guadiana, according to Link, the principal rock is granite. The long ridge of the Sierra Morena contains principally transition rocks; granite breaks out on its southern foot towards the Guadalquiver. This rock, so frequent in the Iberian peninsula, appears to be wanting in the highest southern chain. The middle mountain ridges consist of mica-slate, abounding in garnets, which, in the ridges lying before them, passes into less crystalline mica-slate, chlorite-slate, and clay-slate, which sometimes inclose beds at times of vast magnitude, of compact limestone, marble, dolomite, and serpentine. On the south coast, newer transition-slate and grey wacke-slate, with beds of flinty slate, lie here and there on the older slate. The basis or fundamental rock of the Rock of Gibraltar is of these rocks.

The structure of the chains of mountain corresponds in general with their chief direction. Not only the alternations of the different rocks, but also the direction of the strata, are conformable with the direction of the chains; hence, in the greater part of Spain, the principal direction of the slaty rocks is from SW. to NE. or WSW. to ENE. But the inclination of the strata varies. In the Pyrenees properly so called, the dip of the strata is conformable with the two acclivities of the range. In the Somosierra and Guadarrama ranges, the principal mass of gneiss dips SE. towards the granite lying before it. In the Sierra Morena, the predominating dip of the slaty strata is towards the NW., so that they appear to rest on the granite which breaks from under them. In the Sierra Nevada, the dip of the strata is conformable with the two acclivities of the chain. It is worthy of remark how the curvature of the south coast of Spain obeys the direction of the strata, and how the formation of the far projecting southern point of the land also stands in connection with the direction of the strata. At the foot of the Rock of Gibraltar, the slaty strata run nearly north and south, with a rapid dip towards the east. The Gut of Gibraltar is therefore nearly at right angles to the direction of the strata. The rocky wall between the Mediterranean and Atlantic seas, by this direction of the strata, must have opposed the strongest resistance to the currents.

The primitive and transition rocks, in very different places, are rich in ores. The present mines are confined principally to the south-west and south-east parts of Spain. The mighty lead-glance veins of Linares occur in granite; the colossal deposite of lead-glance in the Sierra de Gador, which afforded, in the year 1828, 600,000 cwts. of lead, is distributed in masses (putzen), in a limestone which may be referred to the oldest transition-rocks, and the rich mercury mines of Almaden, are contained in clay-slate.

The secondary rocks also assist in forming the principal Spanish mountain chains, but in a different manner. They ascend to a great height on the Spanish side of the Pyrenees, even some of the highest summits are of secondary rocks. The western continuation of the Pyrenean chain consists, in the Biscayan provinces, principally of secondary rocks; and it is probable that the lofty limestone mountain ridges which separate Austurias from Leon, is a continuation of the Biscayan secondary formation. On both sides of Somosierra the primitive rocks are skirted by those of the secondary class, but they are far from the middle and higher parts of the mountain chain. When we follow the road from Madrid to Andalusia, we meet with secondary rocks near the transition clay-slate of the passes of the Sierra Morena, but we must descend very low on the south side before we meet with similar rocks. The high mountains of Jaen are formed of secondary rocks. In the northern vorgeberge of the Sierra Nevada, between Granada and Guadiz, there are secondary deposites, which are not, however, so considerable and extensive as to reach to the higher ridges. Also in the vicinity of Malaga new secondary rocks lie on the foot of older mountain masses, and ridges of secondary rocks extend from the hills of Ronda towards the southern extremity of Spain. The wonderful isolated Rock of Gibraltar is also principally composed of new secondary rock. The distribution of the rock is not confined to the immediate vicinity of the higher mountain chains, but it extends from the one to the other, rises or falls in the intermediate spaces, and forms in this way the widely extended high table land.

The most important of the Spanish secondary rocks are the following, viz. *variegated sandstone* and *marl*, *gryphite limestone* and the *white limestone* or *Jura limestone*. The first of these exhibits the same relations as in Britain, where it is known under the name New Red Sandstone, or Red Marl. The *shell limestone*, which, in Germany, is enclosed between Werner's variegated sandstone, and the younger variegated marl formations, is wanting in Spain, as is also the case in England. The sandstone and marl is rich in gypsum and masses of rock-salt. At Vallecas, near to Madrid, and in some other places, there rests upon it, in single beds, that rare deposite consisting of *meerschaum*, with nests of siliceous minerals. It is to this formation, which occurs widely spread over the high table-lands of Old and New Castile, that these countries owe the reddish-brown colour of their soil, and the tiresome uniformity of their surface. The *lias formation* is widely distributed in the northern provinces of Spain. It appears to reach a considerable height on the Spanish side of the Pyrenees. In the Biscayan provinces, it exhibits the same characters as the gryphite limestone of the Weser, and is so widely distributed that nearly all the older rocks are covered by it. Here it is remarkably prolific in an excellent iron-ore. The immense mass of sparry iron-ore, converted by decomposition into brown and red iron-ores, of Somorostro, near to Bilboa, and which probably forms the ironstone hills mentioned by Pliny in the 34th Book of his Natural History, belongs to this formation. Probably also the vast beds of coal in the Austurias are subordinate to it. The *white Jura limestone*, which is one of the most widely distributed formations, is also of great geognostical importance in Spain. It forms, in most places, the immediate cover of the variegated sandstone and marl, and occurs in the north, and also in the south of Spain, in single ridges, and great mountain masses. This formation is exhibited in its most characteristic forms in the narrow pass of Pancorbo, in Old Castile, in the lacerated mountains of Jaen, and the isolated rocky wall of Gibraltar. Wherever it occurs, its presence is announced by the yellowish-brown colour of the soil with which it is covered.

Some members also of the *chalk formation* occur in Spain. The sandstone of the rocky ridge of the southern coast, between Cadiz and Gibraltar, and the limestone in the district of Los Barios, bring to our recollection the rocks of the Saxon Switzerland. The first agrees with the German *quadersandstein*, the latter with the Saxon *planer limestone*, an equivalent for impure chalk.

Tertiary deposites do not appear to be particularly abundant in Spain. In the south, particularly near the sea-coast, there is a deposite, filled with marine organic remains, in which calcareous sand and pebbles occur, partly in a loose mass, and partly more or less firmly compacted by means of a calcareous cement. Judging from the included petrifactions, among which are beds of oyster-shells, this deposite, on which Cadiz stands, and which, in some places, rises into hillocks and low hills, belongs to the *upper tertiary sea-water formation*. Probably the tertiary deposite mentioned by Brongniart as occurring in the neighbourhood of Barcelona, belongs to the same deposite. That *fresh-water limestone* occurs in Spain has been sufficiently proved by the observations of Baron Von Ferussac. The deposite very much resembles that so generally distributed in Germany, and is found in different parts of Spain, both in the interior and on the coast, and at different heights. The *calcareous breccia*, generally with a ferruginous basis, which occurs principally in the south-west, where it is widely distributed, belongs to the latest of the *antediluvian deposites*. It not only incrusts limestone rocks of different formations more or less thickly, but also fills up rents and fissures in them; thus it abounds among the calcareous rocks of Gibraltar, where it sometimes contains bones of quadrupeds no longer met with there. The formation of this breccia is ascribed to a catastrophe which affected different parts of the coast of the Mediterranean sea. As Professor Hausmann had not an opportunity of travelling in Murcia, he was not able to confirm or reject the accounts of Spanish geologists, who maintain that it contains *true volcanic* rocks. The occurrence of other rocks, which are conjectured to have come from below, has been noticed in but few places. Characteristic basalt occurs in Catalonia. The porphyritic and basaltic looking rocks, extending from Cabo de Gata, and from Avila, on the north side of the Guadarrama range, are still problematical. Hypersthene-rock has been found by Professor Garcia in the vicinity of Salinas de Poza, in Old Castile, in contact with Jura limestone. Professor Hausmann found in the mountains of Jaen, near to variegated marl containing masses of gypsum, rocks of greenstone.

Prof. Hausmann concludes his discourse with some remarks on the more general geological relations of Spain, in which he pointed out the influence of soil and climate on the other departments of nature, as also on the peculiarities and occupations of man. A glance of the whole nature of Spain discovers a threefold principal difference. The northern zone, which extends to the Ebro, differs entirely in its characters from the middle zone; and this again is completely different from the southern zone, which is bounded on the north by the Sierra Morena and a part of the Ostrandes. The northern zone, which includes Gallicia, Austurias, the Biscayan provinces, Navarre, the northern part of Arragon, and Catalonia, is a widely extended mountainous and hilly country. The snow-fields and glaciers of the Pyrenees on the one side, and on the other the north and north-west winds, have a marked influence in lowering the temperature of the atmosphere, and in increasing the supply of water. The increased humidity is favourable for vegetation, which, on the whole, very much resembles that of the south of France; and the variety of rocks containing lime, clay, and sand, and also their frequent alternations, operate beneficially on the soil. The soil every where invites to cultivation, and the Catalonians and Biscayans are active cultivators of the ground. The middle part of Spain, to which belongs Old and New Castile, a part of Arragon, Leon, and Estremadura, is not so favourably circumstanced. In general, we rarely meet with either beauty or variety of aspect. The extensive and lofty table-lands, destitute of trees, are dull and tiresome; their uniform and monotonous surface, formed by vast deposites of horizontally disposed secondary strata, is swept across by the wind, and burnt up by the rays of the sun. Whichever way the eye turns, it meets with scarcely any thing but wretchedly cultivated corn-fields, and desert heaths of cistus. Seldom, in general, more in the southern than in the northern districts, plantations of olive trees afford a meagre shelter, and vary the scenery, although in an inconsiderable degree. Nothing certainly has so great an influence on these properties of nature, with which many of the peculiarities and modes of life of man harmonize, than the high situation of the widely extended table-lands, and the uniformity of the rock which forms the support of the soil. It is owing principally to the horizontal stratification, and the want of water, that the great Spanish table-lands are so widely extended, and so little intersected by deep valleys.

The rivers, in most cases, carry but little water in comparison to the magnitude of the land, and the number of considerable mountain chains; and it is further surprising how insignificant the waters of most of the Spanish mountain groups are, even when the qualities of the rocks favour the formation of springs. The causes of this great deficiency of water are principally the great dryness of the atmosphere—the inconsiderable cover of snow on the mountains, and its short continuance—the absence of forests, and the want of great moors on the heights, and the comparatively inconsiderable breadth of the mountain ranges. The southern and south-western part of Spain, which comprehends Andalusia, with Granada and Murcia, is very different from that just described. On the opposite side of the Sierra Morena the whole land has a more southern and foreign aspect, a breathing of that African nature, which announces itself not only by the world of plants, but also by the animal world, and man himself. The great difference of climate is produced by the southern situation, the exposure of the acclivity on the south and south-west to the African winds, and the strong reflection of the solar rays from the lofty, naked mountain walls. The mountain ranges are more closely aggregated, the valleys more deeply cut: there is no room for very extensive tablelands, and the more limited ones that occur, as those of Granada, are more amply supplied with water than those in the middle of Spain. Along with this arrangement, there is greater difference among the rocks, and also of their position. The south of Spain, therefore, possesses not only a much higher temperature, one fit for the orange and the palm, but also a more varied and more favourable soil for cultivation. But these relations would have acted more beneficially if the air had been more humid, and moisture had been everywhere more abundant. The deficiency of moisture is the principal cause not only of the striking meagerness of phenogamous vegetation, on the most of the mountain acclivities, but also of the remarkable paucity of lichens and mosses on the mountains on the coast; and in connection with this is the fact, that the weathering of the rocks, and the reforming of the original surface of the mountains, assume there a somewhat different course from what is observed in places which are moister, and provided with a more powerful vegetation.

Description of an Apparatus for Evaporating Fluids, and also for separating Salts from their aqueous solution by Crystallization without the aid of the Air-pump. By P. A. Von Bonsdorf, Professor of Chemistry in the Alexander University in Finland.

When we wish to evaporate gradually the water of a solution, and particularly to dry such matters as will not bear exposure to heat without being decomposed or otherwise changed, we employ, as is well known, free or rarified air, in which the aqueous vapour as it rises is removed by substances, particularly sulphuric acid, that greedily absorb moisture. But, as the air-pump, the instrument employed for obtaining a vacuum, is not in the possession of every one, and besides it is difficult to procure one in which the bell-glass will remain long in the state of a vacuum, and even the best is so far inconvenient, that in it only a small number of evaporations can go on at the same time, the account of another method for evaporating water will not, we think, prove unacceptable to the friends of science.

In a series of experiments I undertook, in the year 1826, on the salts which are formed by the union of the chloride of electro-negative and electro-positive metals, I procured a number of salts, which (as they could only be prepared in small quantities), it was nearly impossible to obtain well crystallized, particularly when they had a tendency to deliquesce. I found myself, therefore, arrested in the midst of my investigations, because one air-pump only was at my command. This difficulty induced me to think of other means. It appeared to me that air has little or no effect in retarding evaporation, providing it is kept dry or nearly so; that is, if the aqueous vapour is absorbed by an appropriate substance as fast as formed. I therefore tried whether or not a saline solution, placed under a bell-glass, in which there was at the same time a saucer with sulphuric acid, could be evaporated to crystallization, and actually found that, by this arrangement, my object was gained, notwithstanding the pressure of the atmosphere.

The following is a description of the apparatus I used for this purpose, We pour into a flat-bottomed vessel of glass or porcelain, after it is placed in a horizontal position, sulphuric acid, until it filled it about one-third of its height, and then place in it several small wine-glasses, and on these, as supports, the vessels with the solution to be evaporated. This arrangement is represented in Plate III. Fig. 4. In order to save room, the supports or wine-glasses should be of different heights, and the vessels of different sizes. I use, in preference, for evaporation, small glass vessels, which are provided with a knob on the bottom. In this way they stand more securely, and we can, after a part of the salt is crystallized, pour out part of the solution, and allow crystallization to take place in another part. In order to effect this, we give the vessel an oblique position, by placing the knob on the edge of the support, as represented in Plate III. Fig. 5.; we can also place the vessel on a larger support or wine-glass, as is represented at *a*, Fig. 5. Plate III., if the fluid is to be taken from another vessel. If the salt deliquesces in the air, this mode of separating the mother liquor from the crystals is very advantageous. But otherwise it is convenient to place the vessel in the way described, because thereby the mother liquor is quickly and certainly separated; in salts that do not deliquesce, we rather place the whole in the open air.

I have found, besides the advantages already mentioned of this form of evaporating vessels, that those in which the bottom is flat in the middle, and rounded on the sides, as represented in the figures *e e*, are the most proper for the formation of crystals, and the most convenient for removing the crystals without injury; the common semi-globular dishes are by no means so advantageous when the salt is disposed to shoot into long four-sided prismatic crystals or needles; the crystallization takes place most freely in a vessel with an entirely flat bottom, as *d* in Figs. 4. and 5. Plate III.

Another, and probably more convenient, arrangement is the following: We procure a vessel of glass or porcelain, with a flat bottom, and nearly perpendicular sides, and a tubulated bell-glass, having a simple rim, and of such dimensions that it can stand undisturbed in the vessel, and when sunk in the sulphuric acid, atmospheric air will at same time be excluded. Fig. 5. Plate III. represents this apparatus. The opening of the bell-glass is shut either with a stopper, or also, as represented in the figure, is covered with a smaller bell-glass. If we wish access to the evaporating dishes, we remove the stopper or the small bell-glass, raise the large bell-glass, and in an oblique direction, in order to prevent the splashing of the sulphuric acid, and place it in the mean time in an empty dish, with the side supported against its rim. I have also found that the tube may be left open, and still the evaporation goes on well, because the dry air in the bell-glass is, as is well known, heavier than the moister exterior air, and thereby the intermixture of this latter is in great part prevented. When tubulated bell-glasses are not to be had, we can use in place of them large flasks with straight sides, the bottoms of which are cut off *.

By means of this apparatus, I have succeeded in producing not only well formed crystals of the new compounds already mentioned, but also distinct shoots of combinations of substances, which were held to be partly incapable of crystallization, or had hitherto been known only in confused forms.

Observations on the Theory of Capillary Action given in the Supplement to the Encyclopædia Britannica. By EDWARD SANG, Esq. Teacher of Mathematics. Communicated by the Author.

IN the article Capillary Action, inserted in the Supplement to the Encyclopædia Britannica, it is assumed, as the basis of the theory, that the attraction existing between the particles of matter extends only to distances which are insensible when compared with the extent of capillary action. And, in order to explain the elevation of a fluid at the sides of a partially immersed solid, we are told, that the attraction of the solid (K′—½ K) first causes the elevation of the adjacent film, that this film then acts as a second solid, raising that immediately adjoining, and that thus the disturbance extends to the entire surface of the fluid; nor does the author stop short here, for he assumes that the weight of the whole elevated fluid is proportional to the horizontal extent of the surface which causes its suspension.

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* The best mode of cutting off the bottom of flasks is to tie round them a cord dipped in oil of turpentine, and then set fire to it.

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These assumptions appear to me inconsistent with all the observed properties either of solid or fluid matter. The first of them, indeed, accords exactly with the observed non-disturbance of a fluid's surface, until a solid is brought into actual contact with it. But although the action of the solid has only an evanescent extent before contact, it does not therefore follow, that after contact has taken place, its influence is not sensibly extended; neither can such a supposition be admissible when it leads us to conclude, that a mass of matter is elevated and sustained by a force applied only at one extremity, and which, therefore, does not pass through its centre of gravity.

The subject is one of great importance, and I imagine that a scrutiny of the reasoning may not be unacceptable. In conducting this examination, I shall first demonstrate the inadequacy of the hypothesis to account for the phenomena, and then attempt to indicate that error which has led the celebrated author of the above-mentioned paper to a conclusion exactly opposite.

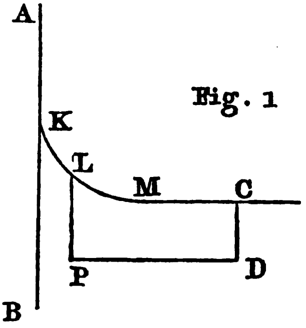

Fig. 1

Let AB represent the vertical face of a solid partially immersed in a fluid whose horizontal surface is CM, its disturbed surface MLK. Having traced a canal vertically from C to D, thence horizontally to P, and afterwards vertically upwards, to terminate in the disturbed surface at L, it is obvious, that the equilibrium of the fluid contained in this or any other canal, is essential to that of the whole mass. Now the horizontal portion DP is already in equilibrium with respect to all the attractions acting upon itself, since the attraction of the plate is not supposed to extend so far, and it may therefore be regarded as the mean of communication between the two vertical branches CD and LP; the pressure at the lower extremities of which must thus be equal. Now these pressures are caused, in the *first* place, by the weights of the two masses; and, in the *second*, by the attractions of the fluid upon the minute portions situated at the two orifices C and L. But, θ being the inclination of the surface at L to the horizon; K the attractive force at C; the quantity of fluid at L, subjected to the attraction, is proportional to the secant of θ, and therefore the whole attraction is K sec θ. But of this force one portion is acting in the direction of the canal, the other against its sides. The former of these two is as the cosine of θ, and hence the compression caused in the canal is K sec θ. cos θ or K itself. The fluid therefore is (as indeed is demonstrated in the third section of the subject-paper) in equilibrium with respect to the force of cohesion; but it is not so in respect to that of gravity, so that the equilibrium cannot take place unless the surface LMC is horizontal.

The same conclusion might have been deduced from the consideration of the equilibrium of a particle of fluid situated at the point L. Such a particle is acted on only by two forces; that of gravity, and the cohesion of the fluid; now the latter of these is already perpendicular to the surface, wherefore no equilibrium can exist, unless the other also is perpendicular to it, that is, unless the surface at L be horizontal.

The above reasoning appears to me sufficiently conclusive; yet, as the method differs considerably from that which has occasioned these remarks, it may not be improper to consider the subject in the same light with our author.

Let, then, MLK represent a small portion of the inclined surface, LP a vertical plane; a particle placed at L is attracted by the whole fluid with a force K, whence that portion of this force produced by the wedge MLP, is $\frac{1}{2}K - \frac{1}{2}K \sin\theta$; and the part due to the wedge PLK is $\frac{1}{2}K + \frac{1}{2}K \sin\theta$. After establishing, in the most distinct manner, this proposition, he proceeds:

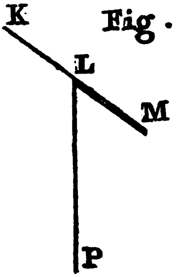

Fig. 2

"Returning now to the canal below the vertical plane PL, and the level surface of the fluid, let θ denote the inclination of the curve at L to the horizon; the canal would be in equilibrium with respect to the corpuscular forces that act upon it, if the attractions upon all its vertical sides were equal. But, according to what has just been investigated, the upper end is attracted by the fluid beyond the vertical plane PL, with a force equal to $\frac{1}{2}$ K + $\frac{1}{2}$ K sin θ, and the attractions upon each of the remaining sides is only equal to $\frac{1}{2}$ K; wherefore there is an excess of attraction equal to $\frac{1}{2}$ K sin θ, which causes the drop of liquid at the upper end of the canal to press on the fluid above it, with a force equal to $\frac{1}{2}$ K sin θ acting upward, and sustaining the part of the ring cut off by the vertical plane LP."

Now, here it is to be remarked, that the force $\frac{1}{2}$ K + $\frac{1}{2}$ K sin θ, is part of the entire force K, and that it acts not upwards, but in the direction of the normal to the curve surface at L, and that, instead of tending to support the superior fluid, it merely goes to generate a compression in the interior nucleus.

If we examine the composition of this force aright, one part of it, K cos θ, is acting in the direction of gravity, and the other, K sin θ, impels the drop of fluid at L in a horizontal direction; but in establishing, from this decomposition, the conditions of equilibrium, we are at liberty to reject none of these forces; yet, granting that we were so, it appears to me very improbable, that the part $\frac{1}{2}$ K sin θ retained, would produce the effect in question. I can easily conceive that a repelling force at L, might tend to support the superior fluid; but how an attraction can do that is to me quite mysterious; it appears as if I were told, that, standing to the northward of another person, and pulling him, this exertion would tend to push me northward.

My principal object, in making these remarks, is to prevent the belief that a complete solution of the difficulties of this important subject has been attained. I have as yet seen no satisfactory explanation of the elevation and depression of the surfaces of fluids, when brought in contact with solid matter; and these investigations induce me to believe, that the whole appearances are due to a change in the corpuscular arrangement produced by the simple contact of a heterogeneous substance, the laws and nature of which change are, and perhaps for ever will be, unknown to us.

32. St Andrew's Square,
Edinburgh, Feb. 8. 1830.

Account of the Larva of a supposed Œstrus Hominis, *or Gad-Fly, which deposites its Eggs in the Bodies of the Human Species; with the particulars of a Case communicated by Dr* Hill *of Greenock.*

An accurate knowledge of the natural history of the genus Œstrus (gad-fly or *breeze)*, is of great importance in an economical point of view, when we consider that the most valuable of our domestic animals, the horse, ox, and sheep, form the usual nidus for their development and increase, and are frequently incommoded, sometimes essentially injured, or even destroyed, by their attacks. The insect called *botts* by farriers, is the larva of the *Œstrus Equi*, and although Mr Bracy Clark (to whom we owe the best account of that and other species of the genus *), concludes that, upon the whole, they are not injurious to the horse, it appears from the accounts of Valisnieri, that the epidemic which proved so fatal to the horses of the Mantuan and Veronese territories during the year 1713, was primarily occasioned by these larvæ. The disease called *staggers* in sheep is likewise occasioned by an insect of this genus *(Œstrus ovis)*, and the hides of cattle are perforated by another kind, which lives beneath the skin. The reindeer of the Laplanders, which has been said to unite in one animal the useful qualities of many, is more than almost any other a martyr to a species of gad-fly, probably peculiar to itself, and therefore named by naturalists *Œstrus Tarandi*.

That man himself, the " Lord of the Creation," should be the subject of similar attacks, is not so generally known. Humboldt, however, mentions, that he examined several South American Indians, whose abdomens were covered with small tumors, produced by what he inferred (for no very positive information seems to have been acquired on the subject) to have been the larvæ of some species of Œstrus. Larvæ of analogous forms have also been detected in the frontal and maxillary sinuses of Europeans; and the surgical and physiological journals of our own and other countries, have reported extraordinary instances of flies, beetles, &c. working out their way from different parts of the human frame.

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* 3d Vol. of *Linn. Trans.*

Mr Clark mentions a case in which the gad-fly of the ox appears to have left its accustomed prey, and deposited its eggs in the jaw of a woman, who eventually died of disease produced by the botts which sprung from the eggs. Leeuwenhoeck obtained maggots from a glandular swelling on the leg of a woman. These he fed with flesh till they assumed the pupa state, and afterwards produced a perfect insect as large as a flesh-fly. Lempriere in his work on the *Diseases of the Army in Jamaica*, records the case of a lady, who, after recovering from a dangerous fever, died a victim to the maggots of a large blue fly, which sometimes buzzes about the sick in the West Indies, and which, in the case alluded to, made their way from the nose through the *os cribriforme*, and so to the brain. A revolting instance of *scholechiasis* is narrated in Bell's *Weekly Messenger*, as quoted by Messrs Kirby and Spence *. A pauper, of the name of Page, was in the habit of secreting the remnants of his food betwixt his shirt and skin. On one occasion, a piece of flesh was so concealed, when the poor man was taken ill and laid himself down to repose in a field in the parish of Scredington. The weather being hot, the meat speedily became putrescent, and was *blown* by the flies. The maggots, which were of course hatched almost immediately, after devouring the meat, proceeded to prey upon the body of the pauper, whose still living form, when discovered by some neighbouring inhabitants, presented a most appalling spectacle. He was carried to a surgeon, but died a few hours after the first dressing of his wounds.

These, and other similar cases, ought not to be considered so much in the light of ordinary or natural effects, as the result of accidents produced by filth and disease. It is otherwise, however, with the gad-flies, whose natural habit appears to be to deposite their eggs beneath the skin, or among the hairs of quadrupeds, in a healthy or unimpaired condition. Although systematic authors have described an *Œstrus hominis*, said to deposite its eggs beneath the skin of man, and to produce ulcers, which sometimes prove fatal, yet nothing seems to have been added of late to these vague indications, in illustration of its real history.

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* *Introduction to Entomology*, vol. i. p. 138.

The following is an authentic instance, which lately occurred to our knowledge, and with the particulars of which we were favoured by Dr A. Hill of Greenock. George Killock, steward of the ship Cecilia, while in the harbour of George Town, Demerara, during the month of September 1828, felt an extreme itching in a spot situated on the lower and back part of the right arm, which he frequently rubbed and scratched. The feeling was quite different from that caused by the bite of the musquito or sand-fly, with which he was sufficiently familiar. Ere long, something like a boil or indolent tumour formed, which occasioned great pain, as if a sharp instrument had been thrust into the arm, or as if suppuration was going on at the bones. This extreme pain came on periodically in paroxysms, and the arm was poulticed for a length of time. The swelling was not so great as to affect the movements of the joint, and as there was no appearance of its *coming to a point*, applications were given up. One day, about five weeks after the commencement of the pain, Kellock observed some bloody matter on his shirt-sleeve, which he shewed to the captain, when the latter distinctly perceived something in motion in the centre of a small orifice, which had become apparent on the tumour. The motion increased, till, to his surprise, the head of an insect protruded itself; and this it continued to do daily, though the animal was observed to withdraw into its burrow when any one came near, or even pointed at it. The pain at this time was so acute as to cause sickness. The chamber of the insect seemed exactly to fit its body, and merely admitted of its motions outwards and inwards. It occasionally discharged a quantity of blood-coloured matter. Many attempts were made to seize it, but it always instantly retreated, and the captain, not knowing but that it partook of the nature of the Guinea worm, with which he was well acquainted, was fearful of a forced extraction, lest it should break asunder, and leave a principal portion in the wound. However, it was observed to protrude more and more of its body every day, and, upon one occasion, it came out to the length of more than an inch. At last it dropt out of its own accord upon the cabin-floor, with a noise resembling tha which a pebble would make on falling on the ground. It kept moving and turning about for some time, like an earth-worm, but, ere long, shrunk into nearly half its previous size. The atmosphere was at this time cool, the ship being within a week's sail of Greenock. The insect lived for three days, and was then put into spirits, after which it shrunk still more. Calculating from the period at which the itching was first felt, it had lived in Killock's arm, in the larva state, for about six weeks. The wound healed readily, leaving externally the appearance of a small scar.

In the 12th edition of the *Systema Naturæ* there is no mention of this insect. Gmelin, however, says, that it dwells beneath the skin of the abdomen *six months*, penetrating deeper if it be disturbed, and becoming so dangerous as sometimes to occasion death. In Dr Turton's *General System of Nature*, there is the following notice of this insect, or of one of which the habits are similar. " *Œstrus hominis.* Body entirely brown. Inhabits South America, *Linne*, *ap. Pall*, *Nord. Beytr.* p. 157. Deposites its eggs under the skin, on the bellies of the natives; the larva, if it be disturbed, penetrates deeper, and produces an ulcer which frequently becomes fatal."

We are informed that Killock, previous to this attack, while at work, usually wore his shirt-sleeves rolled up above his elbows; and that, while in George Town, Demerara, he generally slept on deck. It is easy then to suppose, that the Œstrus or parent fly had availed itself of a proper opportunity to deposite its egg upon his arm, probably by a slight puncture of the skin, by means of the ovipositor with which it is furnished. When the larva had attained its full size, it dropped out, instinctively searching for a covering of natural earth, in which to undergo the intermediate state of pupa, which it is destined to assume for a time before it becomes a winged insect. The instinct of the parent, however admirable under ordinary circumstances, was of course insufficient to provide against the accident of Killock's being a seafaring man,—and the larva could not have attained the perfect state, for want of the proper nidus in which the pupa is accustomed to repose. Had a flower-pot containing earth been on board the vessel, the different changes of the insect might have been observed, and our knowledge of the species completed. As it is, we are acquainted with the larva alone. Its description is as follows:—

Length, in its present shrivelled condition, seven-tenths of an inch; circumference round the centre or thickest part one inch; colour pale dingy apple-green, tinged with brown. The mouth appears to have been somewhat tubular, but is furnished on its upper part with a pair of sharp minute hooked crotchets, of a shining black colour, probably for the purpose of adhering more firmly to the spot from which it was desirous to draw its food. The eyes are large and prominent; their colour brown. The body is composed of nine rings or segments, exclusive of the head and anal portion. There are thus, in all, eleven segments, besides the mouth, the exact number of which the larvæ of the European species consist. There are no feet. These organs are, however, obviously supplied by transverse circles of small black spines or hooks, with which the principal segments of the body are furnished; and, besides these, there are several rounded unequal protuberances on the back and sides. The latter are possibly produced or rendered more apparent, by the decrease of size which has taken place. Supposing these minute spinous hooks to be, along with the skin, under the control of muscular action, (and Lyonnet has beautifully exhibited the complicated muscular structure of another larva), then, according to the direction in which the hooks are pointed, a wriggling motion would produce either outward or inward progression, and serve all the purposes of locomotive organs, just as (to use a familiar illustration) an ear of barley placed within the sleeve of a pedestrian, works its way in a direction opposite to that towards which its *beard* is directed.

Larva of Œstrus Hominis.

Description of the Apparatus or Signal-Post for regulating Chronometers. By R. Wauchope, Esq. Captain R. N. With a Plate. Communicated by the Author.

My Dear Sir,

The enclosed drawing will more fully explain the nature of the plan given in the last Number of your valuable Journal, for ascertaining the rates of chronometers by an instantaneous signal.

In addition to what was there stated, I have only to suggest, that in a situation such as the Calton Hill, for instance, near Edinburgh, where there is an Observatory without a regular observer attached to it, it is not imperative that the true time should be shewn *every* day; but when a meridian observation of the sun *is* taken, the flag may be hoisted at noon, which will intimate that the ball will drop at one o'clock, or any other time which may be fixed upon. The flag should, as mentioned in the accompanying description, be hauled down precisely *one minute* before the *true* time is shewn by the ball.

By this most simple contrivance, any gentleman belonging to the Astronomical Institution, who knew the error of the Observatory clock, might, any day that was convenient, announce the true time to the towns of Edinburgh and Leith, and to the shipping in Leith Roads.

At a foreign port, where a resident observer cannot be obtained, a transit instrument may, nevertheless, be fixed in the meridian of the place, and a flag-staff for the instantaneous signal be erected, and placed under the charge of some careful person, to be used by any man-of-war or merchant ship, having time-keepers on board, touching there; as the observation by the transit of the sun over the meridian, is both more accurate and more easily obtained than by the present method in general use, viz. by a sextant and artificial horizon.

Should this plan for shewing true time be universally adopted, which, from its simplicity, it bids fair to be, both by this country and by France and America, there will then be no port of any consequence into which a ship can enter, where an accurate rate for the time-pieces on board may not be found. Chronometers will be more generally adopted, and the *risk* attached to both *life and property* embarked in ships, be much diminished.

I shall feel much obliged by your giving this a place in the next Number of the Edinburgh Philosophical Journal.—I remain, &c.

R. WAUCHOPE.

EASTER DUDDINGSTONE,
1st February 1830.

Description of the Signal-Post for regulating Chronometers.

DE, Plate V., is intended to represent the interior of an observatory, through the roof of which, the halliards *d* (or hoisting line of the ball C) pass, and are then secured at *x*, by the disengaging lever *y*. *z* is intended to represent a time-piece, or the observatory-clock, by which the signal is regulated. The drawing represents a time-piece *z*, placed upon the same table with the disengaging lever *y*, so as to allow the observer to have his eye upon the time-piece, and his hand upon the disengaging-lever, that the signal may be instantaneous.

A C represent two balls, of four or five feet diameter, made in the usual way of black canvas and iron wire. A B represents an iron rod, which secures the upper ball A, to the upper outrigger, and passes through the diameter of the ball C, and is secured upon the lower outrigger at B. Upon this rod the ball C traverses. A segment of the ball A is cut off at the point of contact of the two balls, as in the drawing, that no daylight may be seen between them, when in the position there represented.

d represents the halliards (or hoisting-line) of the ball C, which is rove through a small block on the upper outrigger, and passes through the centre of the ball C, and through the roof of the observatory, and is there secured by the disengaging lever *y* at *x*, upon the table, where the regulating time-keeper *z*, is placed.

e represents the downhaul of the ball C, at the end of which and about four feet from the ground, a weight is attached.

y x represents the disengaging lever secured on the table, which is explained in the figure below, and so constructed, that a slight movement of the hand at *y* disengages the halliards, which are secured at *x*, so as to allow of an *instantaneous separation of the balls.* The ball C (as above mentioned, having a weight attached to it, at the end of the downhaul) instantly falls to B, along the iron rod A B, which is kept at a distance from the flag-staff by the two outriggers, and which prevents the ball C from being affected by the wind.

The ball C will take about four-tenths of a second to fall its own diameter, five feet, which separation of the two balls constitutes the signal. The halliards should, therefore, be disengaged four-tenths of a second before the true time.

Five minutes before the signal is made, a red flag, with a white ball, should be hoisted as a preparatory signal; and, precisely *one minute* before the ball C drops, the flag should be hauled down. The ball should drop thrice, at the interval of a minute between each time, for the convenience of observers.

Description of the disengaging Lever, as shewn in the Lower Drawing.

aa, *aa* represent two thin upright iron plates, one-eighth of an inch apart, rivetted upon the plate *m n*. *b* is a thin iron plate, with a hole in the lower end, as seen in the separate drawing of it *b x*; this is inserted between the two plates *aa*, *aa*, and has a hook at the top, for a chain at the end of the halliards to hook to; the hole *x*, corresponds with a similar hole in each of the plates (*aa*, *aa*), and is secured in the position, as in the drawing, by the joint R, of the lever *y*, which is here drawn out to shew it. The lever *y* traverses upon the pivot P, having a joint at S, to allow it to play freely. A slight motion of the hand at *y*, disengages the joint R from the plates *aa*, *aa*, and sets *b*, to which the halliards are attached, at liberty, and allows the ball C instantly to drop.

The reason why a chain should be attached to the lower end of the halliards, is to allow for their contraction and expansion in dry or wet weather.

On Miargyrite and Jamesonite.

I. MIARGYRITE.

THIS mineral, formerly confounded with the Red Silver-ore, was first separated from it by Mohs, under the name Hemiprismatic Ruby Blende. H. Rose of Berlin adopts the view of Mohs, but gives to the substance the name of *Myargyrite*, from *αργυρος*, *silver*, and *μειων*, *less*, because it contains less silver than red silver-ore. It is found at Braunsdorf in Saxony. On analysis, it afforded

Sulphur,	21.95
Antimony,	39.11
Silver,	36.40
Copper,	1.06
Iron,	0.62
	99.17

As 36.40 of silver take up 5.41 of sulphur, in order to form sulphuret of silver, and 39.14 of antimony and 14.65 sulphur, the quantity of sulphur in sulphuret of antimony is to that in sulphuret of silver as 3 to 1. This mineral contains, besides, small quantities of sulphuret of silver, sulphuret of copper, and sulphuret of iron. 1.06 parts of copper take up 0.54 of sulphur, in order to form the highest sulphur state; and 0.62 parts iron require 0.74 parts sulphur and 0.62 parts iron, to form sulphuret of iron. The composition of this mineral, which is analogous to that of the zinkenite, is expressed by the following formula,

$$\dddot{Sb} + \dot{Ag}.$$

It results from this composition, that this mineral has the same constituent parts as dark red silver-ore, but in very different relations, so that it cannot be viewed as a mere variety of red silver-ore, but as a distinct species.

II. JAMESONITE.

This mineral occurs in Cornwall and in Hungary; but in neither is it abundant.

It was first described by Mohs, under the name Axotomous

Antimony-glance, afterwards by Haidinger under its present name, which is that adopted by mineralogists. The following three analyses of it were made by Henry Rose:

	I.	II.	III.
Sulphur, . . .	22.15	22.53	...
Antimony, . .	34.40	34.90	33.47
Lead, ...	40.75	38.71	40.35
Lead, with slight trace of Iron and Zinc,	...	0.74	...
Copper, ...	0.13	0.19	0.21
Iron, ...	2.30	2.65	2.96
	99.73	99.72	

The proportion of sulphur taken up by the antimony and lead is as 12.87 to 6.33, also as 2 to 1. The overplus of sulphur is sufficient to form with the iron iron-pyrites. Although the mineral appears to be pure, yet we cannot admit that the quantity of iron-pyrites is an essential ingredient of its composition. The essential composition of Jamesonite may be expressed by the following formula, $2\dddot{S}b + 3\dot{P}h$.

On the relative Age of the different European Chains of Mountains.

Cicero remarks, that he did not conceive how two augurs could look upon each other without laughing. Not many years ago, the saying might have been applied to geologists, without their having much reason to complain; for the science which they professed was then a mere collection of absurd hypotheses, not rendered necessary by any accurate observation. Now, however, the case is different, and geology occupies a place among the sciences. The number of particular investigations of which it is composed is immense, the facts collected are as numerous as accurately observed, and some of the general results that have been deduced from them deserve the greatest attention; for they throw light upon the original state of the globe, and upon the frightful physical revolutions which it has undergone, at distant periods separated by intervals of tranquillity.

Perhaps on a future occasion, I shall present a brief sketch of these great phenomena; but in the present article, I shall confine myself to a single subject, the relative age of the different mountain chains in Europe. In selecting this subject, I have been less determined by its novelty, than by the clearness and methodical accuracy with which M. Elie de Beaumont has treated it. I have also to say, that I have had the advantage of deriving from his friendly communications information without which it would have been impossible for me to draw up the present article, the original memoir not having yet made its appearance. It does not belong to me to foresee the estimation in which geologists will hold M. Elie de Beaumont's investigation; but I am greatly deceived if they will not unanimously consider it as one of the most curious and best conducted. The very favourable report which MM. Brongniart, Brochant, and Beudant have given of it in the Academy of Sciences, will, I suppose, ensure for it the approbation of all the scientific world.

It is an opinion now nearly universally admitted, that the mountains have been formed by upraising; that they have issued from the bowels of the earth by violently perforating its crust, so that there has perhaps been a period when the surface of the globe presented no remarkable inequalities.

Since this view has been adopted, difficulties that have hitherto proved insuperable have disappeared from science. It will be seen for example, how we can now explain the presence of shells on the summits of the loftiest mountains, without supposing that the sea had covered them in their present state. It is sufficient to say, in fact, that these mountains, in issuing from the bosom of the waters, raised with them, and carried to a height of three or four thousand yards, the formations deposited by the sea.

The moment the geologist admits the formation of mountains by means of upraising, numerous interesting subjects of inquiry present themselves to him. He has to ask, for example, if all the great chains have risen at the same period; and in the case of a negative reply, what is the order of their relative antiquity.

Such are precisely the questions which have engaged the attention of M. Elie de Beaumont; and there is reason to think that he has, in some degree, solved them. The following are his results. I shall afterwards pass to the proofs.

The system of the Erzgebirge in Saxony, the Côte d'Or in Bourgogne, and Mount Pilas in Forez, is the first that has been raised of all the mountainous districts which M. de Beaumont has yet considered. The system of the Pyrenees and Appenines, although more extensive and of greater elevation, is of a much less ancient date. The system of the western Alps, of which the colossal mass of Mont Blanc forms a part, was raised long after the Pyrenees. Lastly, a fourth raising, posterior to these just mentioned, has given rise to the central Alps, (St Gothard), the Ventoux and Leberon Mountains, near Avignon, and in all probability, to the Himalayan Mountains in Asia, and the Atlas range in Africa.

I have presented these results first, in the hope that their singularity may engage the reader to follow with more attention the somewhat minute details which will enable us to determine their accuracy.

Among the numerous and diversified deposites of which the crust of the globe is composed, there are some which have been named *sedimentary formations.*

The sedimentary formations properly so called, are composed, in whole or in part, of detritus carried along by the waters, similar to the mud of our rivers, or the sands of the sea-shore. These sands, more or less comminuted, agglutinated by calcareous or siliceous fluids, form the arenaceous rocks called *sandstones.*

Certain limestone formations are also ranked among those which are called sedimentary, even although, which is rarely the case, they leave no sedimentary residuum after being dissolved in nitric acid, the remains of shells which they contain shewing in another and perhaps still better manner, that their formation has also taken place in the bosom of the waters.

The sedimentary formations are always composed of very distinct successive beds. The more recent may be divided into four great sections, which, in the order of their antiquity, are the following:—Oolite or Jura limestone—The green-sand and chalk system—The tertiary formations—Lastly, the first or old transported or alluvial deposites *.

Although all these formations have been deposited by the waters, although they are met with in the same localities, and upon each other, the transition from the one to the next species does not take place by insensible gradations. A sudden and abrupt variation is always observed in the physical nature of the deposite, and in that of the organized beings, whose remains occur in them. Thus, it is evident, that between the epoch at which the Jura limestone was deposited, and that of the precipitation of the green sand and chalk system which covers it, a complete renovation in the state of things took place at the surface of the globe. The same may be said of the epoch which separated the precipitation of the chalk from that of the tertiary formations, as it is equally manifest that in each place the state in which the nature of the fluid from which the formations were precipitated must have completely changed between the time of the tertiary formation and that of the old transported or alluvial formations.

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* With the object which I have in view, an accurate definition of these formations is unnecessary. I might even have contented myself with naming and designating them as Nos. 1, 2, 3, 4. No. 1 would have been, for example, the oldest sedimentary formation of the four, that which the others cover, in a word, the Jura limestone. No. 4 would then be found connected with the superior formation, or that of the transported deposites. I shall, however, give a very brief account of these deposites, in as far as regards their nature and aspect.

M. de Humboldt has given the name of *Jura limestone* to the vast sedimentary deposite of which the Jura Mountains are in a great measure composed, and which is formed by a whitish limestone, sometimes compact and uniform, like the lithographic limestone which is extracted from it, sometimes composed of small round grains named Oolites, whence the designation of *oolitic limestone*.

The sedimentary formation comprising the *green-sand* and the *chalk*, consists of a succession of sandstone beds, often mixed with a large quantity of small green grains of silicate of protoxide of iron, and surmounted by a very thick series of beds of chalk. The beds of both species which form the cliffs of the English Channel are the type of this kind of formation.

The *tertiary sedimentary formation* is that of the neighbourhood of Paris. It is a very varied succession of beds of clay, limestone, marl, gypsum, sandstone, and buhrstone.

Lastly, The *old alluvial formations* derive their name from their resemblance to the alluvia produced by the rivers of the present period.

These distinct and abrupt variations in the nature of the successive deposites formed by the waters, are considered by geologists as the effects of what they have called the *revolutions of the globe.* Although it may seem difficult to say very precisely of what these revolutions consisted, their existence is not the less certain.

I have spoken of the chronological order in which the different sedimentary formations had been deposited. I ought, therefore, to say, that this order has been determined by following, without interruption, each kind of formation into regions where it could be positively determined, and over a great horizontal extent, that a particular bed lay above another of a certain kind. Natural breaks in the strata, cliffs on the sea-shore, common wells, artesian wells, and the cuts of canals, have afforded great assistance in this determination.

I have already remarked, that the sedimentary formations are stratified. In plain countries, as might be expected, the disposition of the beds is nearly horizontal. As we approach mountainous countries, this horizontality generally alters; and upon the sides of the mountains, certain of these beds are highly inclined, and even sometimes become entirely vertical. Could the inclined sedimentary beds which are seen upon the slopes of mountains, have been deposited in oblique or vertical positions? Is it not more natural to suppose, that they originally formed horizontal beds, like the contemporaneous beds of the same nature with which the plains are covered, and that they were raised and turned up at the moment when the mountains on whose sides they rest emerged?

As a general proposition, it does not seem impossible that the slopes of the mountains have been encrusted on the spot, and in their present position, by sedimentary deposites, since we daily see the vertical sides of vessels in which selenitic waters are evaporated becoming covered with a saline layer, the thickness of which goes on continually increasing; but the question which we have proposed to ourselves is not of so general a nature, for all that we have to determine is, Whether the *known* sedimentary beds have been thus deposited? Now, this question may be answered negatively, as I shall prove by two kinds of considerations, totally different from each other.

Incontestible geological observations have shewn, that the limestone beds which form the summits of Buet in Savoy, and Mont Perdu in the Pyrenees, having an elevation of from three to four thousand yards, have been formed at the same time as the chalks of the cliffs on the shores of the English Channel. If the mass of water from which these formations have been precipitated had been raised to a height of from three to four thousand yards, France would have been entirely covered by it, and similar deposites would have existed upon all the heights inferior to three thousand yards. Now, we observe, on the contrary, in the north of France, where these deposites appear to have been very little disturbed, that the chalks never attain a height of more than two hundred yards above the present sea. They present precisely the disposition of a deposite, which had been formed in a basin filled with a fluid, whose level had not attained any of the points at present having an elevation of more than two hundred yards.

I pass to the second proof, borrowed from Saussure, and which seems to me still more convincing.

The sedimentary formations often contain rolled pebbles of a nearly elliptical form. In the places where the stratification of the deposite is horizontal, the longest axes of these pebbles are all horizontal, for the same reason for which an egg does not remain on end; but where the sedimentary beds are inclined at an angle of 45°, the larger axes of a great number of these pebbles also form angles of 45° with the horizon; and when the beds become vertical, the long axes of many of the pebbles are vertical.

The sedimentary formations, therefore, as is demonstrated by the observation of the pebbles, have not been deposited on the spot and in the position which they now occupy: they have been more or less raised at the moment when the mountains whose sides they cover issued from the bowels of the earth *.

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* To be convinced, that in the act of the rising of a horizontal bed, all the long axes of the pebbles which it contains could not have become vertical, one has only to trace lines in different directions on a horizontal plane, and to make it afterwards turn round a certain hinge. In this motion, all the lines parallel to the hinge will remain constantly horizontal. The perpendicular lines to the hinge will, on the contrary, be inclined to the horizon, the whole quantity by which the plane moves; so that, at the moment when it at-

It is now evident that the sedimentary formations whose beds present themselves on the slopes of mountains, *in inclined or vertical directions*, existed before these mountains were reared. The equally sedimentary formations which *prolong themselves horizontally* until they meet these slopes, are, on the contrary, of a date posterior to that of the formation of the mountain: for it cannot be conceived that, in issuing from the ground, it should not have raised at once all the beds that existed in the district.

Let us place proper names in the general and very simple theory which we have just unfolded, and M. de Beaumont's discovery will be proved.

Of the four species of sedimentary formations which we have above distinguished, three, and they are the highest, the nearest to the surface of the globe or the newest, are prolonged in horizontal beds from the mountains of Saxony, the Côte d'Or, and Forez; one, the Jura or oolite limestone, alone is seen raised. Therefore the Erzgebirge, the Côte d'Or, and Mount Pilas in Forez have issued from the globe after the formation of the oolite limestone, and before the formation of the other three sedimentary deposites. On the slopes of the Pyrenees and Appenines, there are two raised formations, viz. the oolite limestone and the green-sand and chalk formation. The tertiary formation and the alluvial formation which cover it have preserved their original horizontality. The mountains of the Pyrenees and Appenines are therefore more modern than the Jura limestone and the green-sand which they have raised up, and older than the tertiary formation and the alluvial formation.

The western Alps (among others Mont Blanc), have raised, like the Pyrenees, the oolite limestone and the green-sand; but they have, moreover, raised the tertiary rocks; the alluvial deposite alone remaining horizontal in the neighbourhood of these mountains. The rising of Mont Blanc must, therefore, have been between the period of the formation of the tertiary rocks and that of the alluvial deposite. Lastly, on the sides of

tains the vertical position, these lines will be themselves vertical. The lines placed originally in directions intermediate between those of these two systems, will form with the horizon angles comprised between 0° and 90°. Now, this is the precise image of the disposition which the large axes of the pebbles affect in the raised strata.

the system of which Ventoux forms a part, none of the species of sedimentary formation are horizontal, the whole four being raised. When Ventoux rose, therefore, the alluvial formation itself had already been deposited.

In commencing this article, I announced, however singular it must have appeared, that the relative antiquity of the different chains of the European mountains had been discovered. We now see that M. de Beaumont's observations have even done more, since we have been able to compare the age of the formation of the mountains with that of the various sedimentary deposites.

I have already called the attention of the reader to the unknown but necessary causes, which have induced variations so abrupt in the nature of the deposites formed by the waters at the surface of the globe. M. de Beaumont's investigation permits us to add to what had been conjectured respecting the nature of these revolutions, some positive notions which are as follows:

The sedimentary formations seem, by their nature and the regular disposition of their beds, to have been deposited in times of tranquillity. Each of these formations being characterized by a peculiar system of organized beings, vegetable and animal, it was indispensable to suppose that between the periods of tranquillity corresponding to the precipitation of two of these superimposed formations, a great physical revolution had taken place upon the globe. We now know that these revolutions have consisted of, or at least have been characterized by, the upraising of a system of mountains. The two first raisings pointed out by M. de Beaumont not being by any means the greatest among the four which he has succeeded in classifying, it will be seen that it cannot be said that, in growing old, the globe becomes less liable to undergo these catastrophes, and that the present period of tranquillity may not terminate, like the preceding, by the sudden irruption of some immense chain of mountains.

Since it remains established that the mountains have not emerged from the globe at the same epochs, it were natural to examine if the contemporaneous mountains do not present some relations of position between each other. This inquiry could not escape the penetration of M. de Beaumont, and the following is the result:—

The directions of the Erzgebirge, the Côte d'Or, and Mount Pilas are parallel to a great circle of our globe, which would pass through Dijon, and would form with the meridian of that city an angle of about 45°.

The contemporaneous mountains of the second rising, viz. the Pyrenees and Appenines, the mountains of Dalmatia and Croatia, and the Carpathian mountains, which belong to the same system, as may be deduced from the descriptions given of them by various geologists, are all disposed parallel to an arc of a large circle, whose orientation will be well determined if I say that it passes through Natchez and the mouth of the Persian Gulf. Thus, whatever may have been the cause, the mountains which, in Europe, have issued from the earth at the same period, form chains at the surface of the globe, that is to say, longitudinal projections, all parallel to a certain circle of the sphere. If we suppose, as is natural, that this rule may be applicable beyond the limits within which it has been determined, the Alleganies of North America, since their direction is also parallel to the great circle which joins Natchez and the Persian Gulf, would seem to belong, in respect to date, to the Pyrenean system. Now, M. de Beaumont has been enabled, in this case, to verify the accuracy of the inference, by a careful examination of the excellent descriptions which the American geologists have given of these mountains. It would appear from this that we might, without much risk, venture to conclude that the mountains of Greece, the mountains situated to the north of the Euphrates, and the chain of Ghauts in the Indian peninsula, which also come very accurately under the condition of parallelism already indicated, must have risen, like the Alleganies, along with the Pyrenees and Appenines.

The third system of mountains in the order of antiquity, that of which Mont Blanc and the Western Alps form a part, is composed of ridges parallel to a great circle, which would join Marseilles and Zurich. In the whole space comprehended between these two cities, the rule is verified with a very remarkable accuracy. The chain which separates Norway from Sweden and the Cordillera of Brazil, being also both parallel to the same circle, have probably perforated the crust of the globe at the same time as Mont Blanc.

For the fourth and last system of which M. de Beaumont has spoken, the great circle of comparison passes through the Empire of Morocco and the eastern extremity of the Himalayan mountains. The parallelism has been verified on the Ventoux and Leberon mountains near Avignon; the Sainte-Baume and many other chains in Provence; and, lastly, the central chain of the Alps, from the Valais to Styria. If parallelism be here also an indication of the date, as there is every reason to believe, we might refer to this comparatively modern system of mountains the Balkan, the great porphyritic central chain of the Caucasus, the Himalayan mountains and the Atlas range.

There is an immense chain of mountains, the most extensive in the world, which, from its direction, cannot be referred to any of the systems above described. This chain is the great American Cordillera. In the deficiency of satisfactory geological observations, M. de Beaumont has indulged in conjectures from which it would seem, with some degree of probability, to result, that this great chain is newer than the fourth of these systems. These conjectures, however ingenious they may be, are too much out of the limit within which I would confine myself, to be given here. Besides, I should apprehend that inattentive persons might confound them with the strict inductions of which I have presented an account, and thus fall into error, I therefore hasten to conclude this article, which, however, I cannot do without remarking how much the purely geographical study of the chains of mountains will be simplified, when the parallelism supposed by M. de Beaumont as a distinctive character of contemporaneous mountains, having been directly verified in the most distant points in the Himalayan range, for example, compared with Mont Ventoux, will take its place among the principles of science. Simple classifications, capable of being retained by the most treacherous memories, and free of every thing arbitrary, as the order of antiquity will be that followed, will then guide us through the inextricable labyrinth of intersecting chains, of which no geographer has as yet been able to present a perfectly satisfactory picture.

Since the results obtained by M. de Beaumont have been made known, I have seen that people were surprised at the circumstance that the chains of the same date were simply parallel to a great circle of the sphere, and did not occur as prolongations of each other. But all that can be inferred from this kind of direction, is merely that the cause, of whatever nature it may be, which has elevated the different mountain chains, while it propagated its action in the plane of a great circle, embraced a zone of a certain breadth, and that the points of less resistance upon the solidified crust do not occur in the direction of a mathematical line, which, indeed, would have been very strange if they had.

A lady of my acquaintance, to whom I had given a brief verbal account of M. de Beaumont's memoir, wished to dissuade me from publishing an account of it, from a dread, that the public might be induced by so apparently strange a theory, to infer, that our present geologists bear a strong resemblance to their predecessors. All my efforts to shew her that the raising up of the mountains is no longer a gratuitous idea, that it results as a consequence from facts, and that it affords the only explanation hitherto made of the inclination of the strata of the sedimentary formations and of many other phenomena, were absolutely fruitless. I then thought of adducing the small raisings which have taken place in our own days. The effect produced by this kind of argument, has suggested to me the idea of employing it here.

No one can deny, that volcanic ejections ultimately form hills, or even mountains of considerable height, upon the surface of the globe. It has been shewn, for example, that the lavas which have issued from Etna, would form a much greater volume than that of the mountain, and the Monte Nuovo, near Naples, was produced by the scoriæ ejected in the space of forty-eight hours only; but this is not the kind of phenomenon of which I intend to speak; the question to be examined is this: Have there been, since the commencement of historical records, portions *already consolidated* of the crust of the earth, which have been raised up in masses by internal causes? Are these deposites, which a revolution of the globe posterior to their formation has elevated in our times, above their original level? The reply to these questions must be affirmative, of which we have the following proof furnished by M. de Humboldt.

In the night of the 28th and 29th September 1759, a piece of ground three or four miles square, situated in the intendancy of Valladolid, in Mexico, rose in the form of a bladder. The limits at which the raising was stopped, are still recognized by the fractured strata. At these limits, the elevation of the ground above its original level, or rather above that of the surrounding plain, is only 37 feet; but towards the centre of the upraised space, the total raising has not been less than 500 feet.

This phenomenon was preceded by earthquakes, which lasted nearly two months; but when the catastrophe happened, every thing seemed quiet, and it was only announced by a horrible subterranean noise which took place at the moment when the ground rose. Thousands of small cones from two to three yards high, and which the natives call *hornitos*, issued in all parts. At length, in the direction of a long crack running from north-north-east to south-south-west, there suddenly arose six large masses, all of them elevated from four to five hundred yards above the plain. The largest of these six hills is a true volcano (the volcano of Jorullo), vomiting basaltic lavas.

We thus see that the most evident and the most distinctly characterized volcanic phenomena accompanied the catastrophe of Jorullo, and that they have probably been the cause of it; but all this says nothing against the fact that an extensive, ancient, and perfectly consolidated plain, in which sugar-cane and indigo were cultivated, has been in our time suddenly transported to a great height above its original level. The eruption of burning matter, and the formation of the hornitos, and of the volcano of Jorullo, so far from having contributed to produce this effect, must on the contrary have lessened it; for all these apertures acting as safety-valves, would have allowed the elevating cause to disperse, whether it was gas or vapour. If the ground had opposed more resistance, if it had not yielded in so many points, the plain of Jorullo, in place of becoming a mere hill 500 feet high, might have acquired the elevation of any neighbouring summit of the Cordilleras.

The circumstances which accompanied the formation of a new island, near Santorino, in the Greek Archipelago, in 1707, seem to be also calculated to prove that the subterranean fires not only contribute to raise the mountains by means of ejections furnished by the craters of volcanoes, but that they also sometimes raise the already consolidated crust of the globe. The extract which I here present of accounts published at the time by Bourguignon and Father Gorée, both witnesses of the event, seems to me liable to no objection. On the 18th and 22d of May 1707, slight shocks of an earthquake were felt at Santorino. On the 23d at sunrise, there was observed, between the large and the small *Kameni* (two islets), an object which was taken for the hull of a wreck. Some sailors went to the place, and on returning reported, to the great surprise of the whole population, that a rock had risen from the waves. In this region, the sea had previously been from 80 to 100 fathoms deep. On the 24th, many persons visited the new island, landed upon it, and gathered upon its surface large oysters, which still adhered to the rock. The island was actually seen rising. From the 23d May to the 13th or 14th June, the island gradually increased in extent and elevation, without noise or shocks. On the 13th June, it might be half a mile in circumference, and from seven to eight yards high. No flame or smoke had yet issued from it. From the moment when the island appeared, the water had been troubled near its shores; and on the 15th June it became almost boiling. On the 16th, seventeen or eighteen black rocks issued from the sea, between the new island and the little Kameni. On the 17th, they increased considerably in height. On the 18th, smoke rose, and great subterranean noises were for the first time heard. On the 19th, all the black rocks were joined together, and formed a continuous island, totally separate from the first. Flames, columns of ashes, and red-hot stones issued from it. These volcanic phenomena were still going on on the 23d May 1708. The Black Isle, a year after its appearance, was five miles in circumference, one mile broad, and more than 60 yards high.

It is evidently seen, in this account, that the appearance and enlargement of the *first* island were not accompanied with any volcanic phenomenon, and that it could not be considered as a product of ejected matter. Now, this is the very idea at which the geologists who reject the theory of upraisings stop short. This island, according to them, was a great mass of *pumice stones*, detached from the bottom of the sea by the earthquake which happened the evening before its first appearance. But, if this were the case, how is the immobility of the floating mass to be accounted for? It cannot be supposed that it always touched the bottom of the sea, for then there would be recognised the existence of a true raising. Now, if the mass floated, it is necessary to say when, and in what manner, it became fixed; whence it derived its support, what were the causes of enlargement and gradual ascent of which the observers make mention, and which, in three weeks, transformed a mere rock, hardly visible, into an island half a mile in circumference. So long as these questions are not answered, the supposition of a raising up of the bottom of the sea will remain the only plausible explanation that has yet been given of the phenomena by which the appearance in 1707 of the *first* new island, in the harbour of Santorin, was accompanied.

I shall now give a third example:—On the 19th November 1822, at a quarter after ten at night, the cities of Valparaiso, Melipilla, Quillota, and Casa-Blanca, in Chili, were destroyed by a frightful earthquake, which lasted three minutes. The following days, in going along the coast over an extent of thirty leagues, several observers perceived that it was greatly raised; for on a shore where the tide never rises more than from one or two yards, any elevation of the ground is easily noticed.

The following are some of the observations from which this remarkable inference was deduced.

At Valparaiso, near the mouth of the Concon, and to the north of Quintero, there were seen in the sea, near the shore, rocks which no person had previously seen. A vessel which was wrecked on the coast, and whose remains the curious went to examine at low water in boats, was laid perfectly dry by the earthquake. In walking to a considerable distance along the sea-shore, near Quintero, Lord Cochrane and Mrs Maria Graham found that the water, even when the tide was up, did not reach the rocks, on which there were sticking oysters, mussels, and other shells, whose animals, but recently dead, were in a state of putrefaction. *Lastly*, The entire banks of the Lake of Quintero, which communicates with the sea, had evidently risen greatly above the level of the water, and in this locality the fact could not escape the most careless observers.

At Valparaiso, the country appeared to be raised about a yard. Near Quintero, it was found to have risen a yard and a third. It has been asserted, that, at the distance of a mile inland, the raising was more than two yards; but I am not acquainted with the circumstances of the measurements which led to this last result.

Here, as is seen, there were no volcanic eruption, no lavas spread out, no stones and ashes projected into the air; and unless it be maintained that the level of the ocean has fallen, it must be admitted that the earthquake of the 19th November 1822 raised the whole of Chili. Now, this last consequence is unavoidable; for a change in the level of the water would shew itself in the same degree over the whole extent of the coast of America, while nothing of this kind has been observed in the harbours of Peru, such as Payta and Callao.

If this discussion had not already been protracted, I might have brought the preceding observations to a close, from which there results that, in *a few hours*, in consequence of some shocks of an earthquake, an immense extent of country may rise beyond its original level, into connexion with those which shew that there is in Europe a large country, Sweden and Norway, whose level also rises, but in a gradual manner, and through a cause incessantly acting, whose nature is not well known. The numerous observations on which this curious result is established, would, however, occupy too much space, and I shall be obliged to omit them for the present.

Observations on the Fontaine Ronde, a Periodical Spring on the Jura. By M. Dutrochet.

The Fontaine Ronde is situated about a league and a-half from Pontarlier, in the road from thence to Lusanne. This very powerful spring has no proper basin, for the water rushes immediately from a declivitous bottom, covered with coarse gravel, which is fifteen paces in length, and six or eight in breadth. The water issues forth uninterruptedly from the deepest lying part of the bottom, but from the highest part it ebbs once and flows once every six minutes. This spring, therefore, is not *intermittent*, but *periodical*. Springs of this description are, in general, but rare occurrences, and the phenomena they exhibit have always attracted the attention of the curious.

Long ago Heron of Alexandria proposed a plausible explanation of the intermittence of springs, in supposing that there were, in the interior of the earth, reservoirs of water provided with natural syphons. This explanation answers well for most cases; hence it has been adopted by natural philosophers. If the intermittence is of unequal continuance, or the swelling of variable height, and if these inequalities are repeated regularly and periodically, we explain them by supposing that there are many dissimilar reservoirs, and that each has its peculiar syphon. All this is possible, and art can, by arrangements of this description, produce appearances resembling those in nature. But, however appropriate this explanation may be, we must not forget that it is a mere hypothesis, and that nature may have other means, besides those already mentioned, for producing the intermittence of springs. The careful study of the Fontaine Ronde has afforded me a proof of this. This spring, as already mentioned, rises during three minutes and falls for the same time, so that its periods have a continuance of six minutes. But I remarked, on frequent visits to the place, that the water did not always diminish in equal quantity. Generally, the highest part of the gravel bottom was entirely exposed by this ebbing; sometimes, however, the water did not fall so low as to uncover the gravel. These anomalies did not exhibit any regularity in their recurrence; and it was therefore difficult to unite them with the periodical regularity which must be produced by one or more syphons. If the intermittence of a spring is caused by a syphon, the reservoir must necessarily be emptied, by means of the syphon, in a shorter time than it would be filled again by the afflux of the water. If the afflux is increased, the reservoir is more speedily filled, and then the period of intermittence is shortened, but the flowing out from the syphon is lengthened. Lastly, when the afflux brings as much water into the reservoir as the syphon carries off, the action of the syphon experiences no interruption, and the spring becomes continuous in place of intermittent.

In the hypothesis of the presence of a syphon, an increase of water in the reservoir must necessarily increase the continuance of the flow and diminish the intermittence, even at length entirely destroy it. But, according to this hypothesis, the period of the rising and falling can never diminish in equal proportion; yet this we found to be the case in the Fontaine de Ronde. Its rise generally continues three minutes, and it occupies the same period for its fall. But on one day I observed that the rise occupied only two minutes, and that the fall took the same time. The period of the spring which, as already mentioned, is six minutes, was on this day only four minutes. This period of four minutes I obtained for a whole hour, during which I observed the spring. This observation convinced me that the periodic swelling or rise of the Fontaine Ronde could not be produced by a syphon: it must result from some other cause, as appears from the following observations.

During the swelling of this spring, a great quantity of carbonic acid rises from the bottom, and the water, owing to the numerous air bubbles that pass through it, appears to be in a state of ebullition. We might suppose that these air bubbles originate from the atmospherical air which had interposed itself among the uncovered gravel during the time of low water, and which was not entirely driven out of the intervening spaces at the moment of rising, but which afterwards, when the gravel bottom was entirely covered, escaped in bubbles through the water. To a belief in this conjecture we might feel supported by the circumstance of the number of the air bubbles being much increased when we stir the bottom with a stick. But when, with the view of ascertaining how far this opinion was founded, I collected a quantity of this gas and mixed it with lime-water, I found that it became clouded. The gas, therefore, was carbonic acid; and that it contained no hydrogen gas was proved by the gas not inflaming. It is evident, therefore, that the rising of the spring is accompanied by an evolution of carbonic acid. This gas, which I conceive to be formed in the interior of the earth, reaches the subterraneous canals of the springs only periodically, because it is only periodically forced out, whilst the spring flows constantly. In fact, the spring flows uninterruptedly and abundantly while the level sinks; but as the swelling begins, air bubbles rise every where from the water, and even from that part of the spring which is the seat of the constant flow. This observation proves that the carbonic acid is not constantly mixed with the water in the subterranean canals, but only reaches them periodically; hence, probably, this periodic flow of the gas into the subterranean canals is the cause of the rising of the spring. There is an opening, partially filled with stones, at the foot of the hill, about fifteen feet from the spring, by which the spring, in the winter, when it is very powerful, pours out its superfluous water, but which is dry during the rest of the year. When we apply our ear to this opening we hear, as long as the rising of the spring continues, a pretty loud bubbling noise; but during the ebb or decrease of the spring, no noise is to be heard. This subterranean bubbling arises, in all probability, from a very considerable evolution of gas. This proves, again, that the gas which occasions the rising of the spring, is not entirely carried off by the water, but that a greater part is developed under the surface of the earth, and escapes by means of other canals, very probably by the opening just mentioned.

We shall not enter into any hypothesis as to the cause of this periodic evolution of gas, but rest satisfied by pointing out its occurrence at the same time with the periodic rising of the spring*.

In the Jura there are other periodic springs, as in the town of Siam in the Canton of Champagnole. Its flux or rise continues seven minutes, its ebb six minutes; its period, therefore, is thirteen minutes. But I did not observe any evolution of gas in this spring.—*Annal. de Chim. et Phys.* t. xxxix., p. 230.

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* Vide Manchester Memoirs, for an ingenious paper by Mr Gooch on this subject.—EDITOR.

On the Height of the Perpetual Snows on the Cordilleras of Peru.

M. Pentland ascertained that the lower limit of the perpetual snows on the acclivities of the eastern Cordillera of Upper Peru, is very rarely under 17,061 feet, while on the Andes of Quito, *although much nearer to the equator*, this limit is only 15,749 feet. M. Pentland, when travelling through the pass of *Altos de Toledo*, in the month of October, found that upon Inchocajo, which belongs to the western Cordillera, the inferior limit of the snow was 1312 feet above the pass, or 16,831 feet above the sea.

The northern back of the Himalaya has already exhibited a similar anomaly, and produced by the same cause. We allude to the influence which the great table-lands ought necessarily to exercise on the law of the decrease of heat in the atmosphere. It is evident if this law had been found for a free atmosphere, by means of aerostatic voyages, the numbers it would furnish would make known very nearly the temperature of the different zones of a mountain, if this mountain was isolated, shot up rapidly into the air, and supported itself on a base of inconsiderable extent, and at the level of the sea. The same would not be the case if the mountain rested upon an elevated table-land; at an equal height the temperature would be more considerable than in the first case. It is also through the influence of the table-land on which the two Cordilleras of Peru rest, that we are enabled to explain how organic life is preserved at so great an elevation. In the Andes of Mexico, between 18° and 19° north latitude, all vegetation ceases at a height of 14,075 feet; while in Peru, at a greater height, in the continuation of the same chain, there exists not only a numerous agricultural population, but also villages and large towns. At present one third of the population of the mountainous districts of Peru and Bolivia, live in regions situated much above that where all vegetation ceases under the same latitudes in the northern hemisphere.

Observations on a paragraph in the last Number of The Edinburgh New Philosophical Journal. By W. J. Broderip, Esq. F. R. S. (Communicated by the Author.)

In a paper which has for its title "Additional Remarks on the Climate of the Arctic Regions, in answer to Mr Conybeare," published in the last number of the Edinburgh New Philosophical Journal, there is, at page 70, the following passage: "In a note to this paragraph, he (Mr Conybeare) adds, that an English Caryophyllea had been described, by Mr Broderip, in the Zoological Journal for April 1828. Mr Broderip, it is true, imagined that 'the hard parts of this indigenous species do not appear to have been any where described;' but had Mr Conybeare been acquainted with the history of British Zoophytes, he might have corrected this mistake, by pointing out that I myself had published (in the 2d volume of the Wernerian Society's Memoirs), a description of the same species, fourteen years previous to 1828; and I may add, that Dr Leach saw my specimens so early as 1812."

It is by no means my intention to follow Dr Fleming through his "Additional Remarks;" but he has charged me with a mistake, and I, most reluctantly, trouble you with my defence, to which I shall strictly confine myself, and which will not long detain your readers from subjects much more worthy of their attention.

My respect for Dr Fleming did not permit me, when I published the passage to which he alludes, to suppose that he could have intended to record, under the name of *Caryophyllia Cyathus*, the indigenous species described by me. When I first saw "*Caryophyllia Cyathus* (Lamark),*" so common in the Mediterranean, announced in the Memoirs of the Wernerian Society as an inhabitant of the sea which washes Zetland, I was somewhat surprised; but the opinion which I entertained of Dr Fleming prevented me from supposing that he had not there found two small individuals of that species, and from concluding that the hard parts of *Caryophyllia Smithii* (the *Caryophyllia* described by me) differing so strongly as they do from those of *C. cyathus*, could have been described by Dr Fleming as belonging to the last-mentioned zoophyte. In his "History of British Animals," published in 1828, Dr Fleming has repeated the record of the species described in the Memoirs, but without the reference to Lamarck. The only *Caryophyllia* recorded in these publications is *Caryophyllia*, or, as Dr Fleming writes it in the latter work, *Caryophyllea Cyathus*; and, in both places, *Madrepora cyathus* of Solander and Ellis is given as the synonym. *Madrepora Cyathus* is *Caryophyllia Cyathus* of Lamarck's "Systeme des Animaux sans Vertèbres,"—of Leach, who has figured and described it as an inhabitant of the Mediterranean in the "Zoological Miscellany," (Lond. 1814, vol. i.), and has there referred to Lamarck's Systeme for the species, and to Dr Fleming, after Lamarck, for the genus,—and again, of the "Histoire Naturelle des Animaux sans Vertèbres." This is the only *Caryophyllia Cyathus*, as far as my information goes, admitted by zoologists in general; and this is certainly *not* the indigenous species described by me in the Zoological Journal for 1828. If Dr Fleming has described the latter, (*C. Smithii*) under the title of *C. Cyathus*, he must pardon me for suggesting that he has confounded two very different species; but I cannot regret the "mistake" which, according to his assertion, I appear to have made, when I supposed him incapable of so doing.

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* Memoirs of the Wernerian Society, vol. ii. Part i. p. 249.

On supposed Vegetable Remains in Chalk. By GIDEON MANTELL, Esq. F. R. S. &c. In a Letter to the Editor.

SIR,

THE author of the interesting "Remarks on the Ancient Flora of the Earth," which appeared in the last Number of your Journal, having stated, upon the authority of the "Illustrations of the Geology of Sussex," that the remains of leaves and fruits of coniferous plants occur in the chalk at Hornsey, &c. I beg leave to offer a few observations in explanation. It is true, that, in the passage referred to, (Geology of Sussex, page 103), mention is made that the bodies in question (the supposed fossil Juli of Cherry Hinton), bear a distant resemblance to the cones of the larch, and that Professor Hailstone had declared their vegetable origin was placed beyond all doubt, by specimens in the Woodwardian collection, and that he had found, in the quarry at Cherry Hinton, the impression of a branch of some vegetable of the fir tribe, with the linear leaves surrounding it; yet it is distinctly stated that M. König believed them to be of animal origin, and that there were specimens in my cabinet with scales of fishes attached to them. It was also remarked (Geol. Suss. p. 158), that their constituent substance was precisely similar to that of the vertebræ and other bones of fishes found in the chalk; and that, from this analogy, I believed they would hereafter prove to be parts of fishes. I scarcely need observe that this conjecture has been recently affirmed by the ingenious experiments of Dr Buckland. Vide *Geological Transactions, New Series*, vol. iii. p. 222. *On Coprolites, &c.*

The arguments of the author of the excellent paper which has occasioned these remarks, are, however, in no respect weakened by this fact, since dicotyledonous wood occurs abundantly in the Galt and green-sand, and sparingly in the flint nodules of the chalk. I am not certain that it has been found in the Hastings' beds.

Castle Place, Lewes, January 20. 1830.

Notes regarding the Serpentine Rocks on Dee Side. By the Rev. James Farquharson. (Communicated by the Author.)

The accompanying specimen of serpentine is of the rock of a congeries of summits of the hill named Coil, about two miles SW. of the Manse of Glenmuick, on Dee Side, Aberdeenshire. Residing some days last July in that neighbourhood, my attention was directed to these summits by their singular aspect, so different from that of the granite mountains with which they are every where surrounded, and the greenness of their surface, amidst mountains every where covered with heath. I took an opportunity one day to ascend them, and found their composition as different from that of the neighbouring granite masses as their aspect, as the specimen shews. Their vegetation, too, is quite different, consisting principally of grasses (various Festucas and Poas chiefly), to the very summit, 700 or 800 feet above the bed of the river, here 700 feet above the sea, with a vast profusion of Silena inflata, then in full flower, but no where else to be seen, and Arabis hispida. The rock is bare in many places near the summits, of a greenish-grey colour, and much softened and weather worn on the surface; fissured like basalt, but not regularly. The principal fissures, however, directed pretty uniformly from SW. to NE. The summits seen from NE. are conical and precipitous in some places, seen from NW.; they are more elongated but precipitous at their E. and W. terminations. There are four or five of them. They rise a hundred feet or two above the general mass of the mountain within the space of about a square mile. The peculiar rock is, however, not confined to the summits, being seen at one place about two miles N. of these near the level of the river. I could not discover its junction with the granite. Many boulders of this remarkable rock are scattered over the granite hills towards the SE. even on the face of the steep hills beyond the river Muick, which bounds the mass in question on the SE. flowing NE. into the Dee. Many fragments of it are also found in the bed of the Dee below the junction of the Muick; but although I passed frequently over the ground, I could find no boulders to the N. or NW. There is asbestus in the bed of the Muick near the base of the Coil. But the specimen herewith sent is very remarkable for the quantity of fixed magnetism which it possesses. The poles are in the line of the stroke of the hammer which broke it off, the place that received the stroke attracting strongly the south pole of a magnet, and the opposite end of the specimen the north pole. The stroke was at the point, where the weather-worn surface is yet seen.

ALFORD, December 19. 1829.

On the Hya-hya or Milk-Tree of Demerara. In a Letter to Professor JAMESON from JAMES SMITH, Esq.*

WHOEVER has read Humboldt's Travels to the Equinoctial Regions of this Continent, cannot but have felt his imagination

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[*] The important discovery contained in this communication from my former pupil, Mr Smith, cannot fail to interest our readers. Ere long we shall be able to publish in the Journal further particulars in regard to the *milk-tree*, and other remarkable trees of Demerara.

powerfully affected by his description of the *Palo de Vaca* or Cow-tree. Such at least I confess was my case to an extraordinary degree. I have journeyed through the country laid down as that where the cow plant grows, but particular circumstances prevented me at the time from seeing it.

In a late excursion, however, up the river Demerara, it was my good fortune to fall in, certainly not with the same kind of tree, but with one possessing the mild milky qualities ascribed by Humboldt to the *Palo de Vaca*. The tree I allude to was fortunately at the time coming into flower, two specimens of which, together with the wood and bark, and a small bottle of the milk, I forward along with this, and beg to have them subjected to your own, as well as the examination of your scientific friends*.

The manner of my discovering the tree was simply this: Among the various productions I had been in the constant habit of inquiring for in the forests, were those trees which yielded milky juices in any abundance, as their saps; and, at different times, I had been led by my Indian guides to a vast variety, all of which, however, had more or less acrid and deleterious principles with the lactescent quality. On the excursion to which I allude, however, I chanced to stop at the little Indian settlement of *Byawadanny*, just below the first rapids of the Demerara, and there I was told of a tree called by the Indians *Hya-hya*, the milk of which was both drinkable and nutritious.

I was then in company with a Mr Couchman, the superintendant of a wood-cutting establishment in the immediate vicinity. We had sent a lad to search around for the tree, and he returned in a short time to tell us he had met with it. We followed him to the spot, and found that he had felled the tree. It had fallen across a little rivulet, the water of which when we arrived, was completely whitened from its juice. On striking a knife into the bark, a copious stream of milk-like fluid immediately followed. Our guide drank of it, and Mr Couchman and myself tasted it after him. It was thicker and richer than cow's milk, and destitute of all acrimony, leaving only a slight feeling of clamminess on the lips. I had already seen that it mixed freely with the water of the little stream, and as I slept that night near the spot, the next morning Mr Couchman and myself drank it in warm coffee. With this it commingled equally well, and lost all the viscosity before perceptible in its pure state, so much so, as to appear to us incapable of being distinguished from animal milk. Mr Couchman was determined, he said, to use it as a substitute for milk at his little neighbouring woodland establishment.

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* The specimens reached me, but only lately, in safety. The milk is now under examination, and a report on its chemical properties will appear in this or next Number of Journal.—Edit.

A variety of experiments, too, have since tended to confirm me in my opinion, that it in no way differs in quality from the vegetable milk of the cow-tree. Yet it was plain that the tree was not that described by Humboldt. The following is the account given of the Palo de Vaca in the Personal Narrative of that distinguished traveller:—"This fine tree rises like the broad-leaved Star-Apple. Its oblong and pointed leaves, tough and alternate, are marked by lateral ribs, prominent at the surface, and parallel. There are some of them 10 inches long. We did not see the flower." You will observe from the specimens I forward of the Hya-hya, that the leaves in no way correspond with those mentioned in the description just quoted. Nor does the tree, in short, bear the most distant resemblance to the "broad-leaved star-apple *."

I extract from my note-book the imperfect description taken on the spot, with a few observations. "Trunk from 16 to 18 inches in diameter, 30 to 40 feet high, branching from the top; bark greyish colour, slightly scabrous, and about a quarter of an inch thick, between which and the wood the milk seemed to be secreted. The incision made by the stroke of a knife into it latitudinally, or diagonally, caused it to flow freely; but when the cut was made longitudinally, little or no milk exuded. The leaves elliptic, and very acuminate; smooth, and in pairs. The flower had not yet fully developed itself, though the corolla was observable, and, as well as could be discerned, appeared monopetalous, with five divisions in the limb. The calyx single, contiguous to the flower, and four-parted; the peduncle axillary, and bearing four flowers, and sometimes

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* It is stated by Mr D. Don, in a preceding Number of this Journal (No. 15, p. 171.), that the Palo de Vaca is a species of Brosimum, and he proposes to call it B. Galactodendron.—Edit.

five." I afterwards attempted to dissect the corolla, and could discover it to belong to the class Pentandria, and order Monogynia. I was unable to obtain the fruit."

I am not aware that the Hya-hya has, either under its Indian, or any other appellation, been ever before made known; and possessing, as I am convinced it does, the chief virtues of the Cow-plant, should it turn out any acquisition to botanical knowledge, I shall feel happy in being the instrument of its discovery.

The milk I send you has now been in bottle thirty-six days: it did not commence to curdle before the seventh day after it was taken from the tree, and even then the process appeared exceedingly slow; so much so, that on the twelfth day I used some of another portion, which had been bottled at the same time, in tea, without its being distinguished from animal milk by those who drank it.

I forgot to mention that I am informed by the Indians, that the Hya-hya is by no means uncommon in the woods of this colony; I may, therefore, very soon hope to procure the fruit.

Note relative to the dried specimen of the Hya-hya. By G. A. W. Arnott, Esq. F.L.S. F.R.S.E. &c.

The specimen transmitted by Mr Smith having been communicated to me for examination, I beg leave to make the following remarks:—

The *calyx* is 5-cleft, very short, the lobes rounded and ciliated. *Corolla* coriaceous, deciduous, hypogynous, monopetalous, hypocrateriform, the mouth naked; the tube elongated (about half an inch long), slightly inflated at the base and towards the apex; the limb 5-cleft, the lobes very short and rounded; æstivation imbricated. *Stamina* 5, alternate with the segments of the corolla, and enclosed in the tube: the filaments are distinct, filiform but short, inserted on the tube about its middle; the anthers are bilocular, opening longitudinally, sagittate, acuminated at the apex, and connivent: pollen granular. *Ovarium* solitary, bilocular; ovula numerous, destitute of hair (*coma*). *Style* 1, filiform, with an incrassated apex, from which proceeds a bifid stigma. I may further add, that the ovula appear to me surrounded by a kind of gelatine, so that I have no doubt but the ripe seeds are immersed in a pulpy matter; but the structure of the pericarp and seeds I cannot determine, as the specimen is only in bud.

Enough is, however, known to enable one to refer this plant to the Apocyneæ, as restricted by Brown, and it is now necessary to inquire its genus.

In the 1st vol. of the Wernerian Transactions, where Mr Brown's paper on this order is published, no genera are described but those which have the seeds comose, to which tribe, from the appearance of the ovarium and ovula, I do not think this can belong. But in the Prodr. Fl. Nov. Holl. p. 467, the genus *Tabernæmontana* is introduced, and the description there given agrees with the above in every point but one. Mr Brown ascribes to that genus two ovaria, although only one style: the same character is given to the genus by Lamarck, and by Vahl (under *T. undulata*), so that there is no doubt of that being necessary to the genus; and the point comes then to be, whether or not, from the bad state of the specimens, I have been deceived. In the mean time, however, although I have found a solitary ovarium in the three buds I opened, I think it may be placed in *Tabernæmontana* until better specimens in flower be procured, and the fruit be observed; more especially as it approaches very closely in other respects to *T. citrifolia*.

In *T. citrifolia*, however, the segments of the calyx are acute; and those of the limb of the corolla linear-oblong, obtuse, and nearly equal in length to the tube. In the species before us, as far as I can judge from the bud, the segments of the corolla are very short and round, somewhat like those of the calyx. The peduncles are axillary from ½ to 1 inch long, bearing a cyme of few flowers. Bracteas opposite; two usually large foliaceous ones at the base of the principal ramification. and two small ovate and ciliated ones subtend each of the other divisions: there is also a similar pair on the ultimate pedicels below the calyx. Perhaps, on account of the foliaceous appearance of the lower bracteæ, they ought to be called leaves, and then the inflorescence would be terminal on short axillary branches.—Petiols opposite, half an inch long; leaves about 4 inches long, and 1¾ broad, oblong, not attenuated at the base, but suddenly acuminated at the apex; they are plane, somewhat coriaceous, smooth, and entire, with diverging veins, that are parallel to each other.

I would propose to name this species *T. utilis*, from the circumstance alluded to in Mr Smith's account of it.

T. utilis; *foliis oppositis oblongis acuminatis integerrimis subcoriaceis planis parallele venosis, pedunculis cymosis axillaribus, calyce obtuso ciliato, corollæ limbi laciniis rotundatis brevissimis.*

HAB. Ad ripas fluminis Demerari.

I may further remark, that, in *T. citrifolia*, the leaves are attenuated at the base: in the allied *T. alba* they are described as undulated, with an acute calyx: and, in *T. laurifolia*, which has the calyx obtuse, the leaves are somewhat obtuse.

The usual properties of the milk of the Apocyneæ are deleterious, and it is rather remarkable to find an instance to the contrary in this tribe; and I do not think there is any other on record. Future observations may, however, perhaps ascertain similar mild qualities in other species of *Tabernæmontana*, especially in their young branches, or when the sap is on the ascent, and before it be elaborated. Among the Asclepiadeæ of Brown, which have similar baneful properties, and which many botanists indeed consider a mere section of Apocyneæ, an instance is also known of the milk being wholesome: I allude to a plant found in Ceylon, which the natives call Kiriaghuna, from Kiri (*milk*), and who employ its milky juice when the milk of animals cannot be procured; its leaves are even boiled by them as a substitute in such dishes as require to be dressed with milk: it is the *Gymnema lactiferum* of Brown. The young shoots of several species of plants belonging to both the Asclepiadeæ and Apocyneæ are used as food.

On the Formation of the Earth. By the late Sir H. Davy [*].

The Stranger.—On these matters I had facts to communicate. On the geological scheme of the early history of the globe, there are only analogies to guide us, which different minds may apply and interpret in different ways. Astronomical deductions, and actual measures by triangulation, prove, that the globe is an oblate sphæroid flattened at the poles; and this form, we know, by strict mathematical demonstrations, is precisely the one which a fluid body, revolving on its axis, and become solid at its surface, by the slow dissipation of its heat, or other causes, would assume. I suppose, therefore, that the globe, in the first state in which the imagination can venture to consider it, was a fluid mass, with an immense atmosphere revolving in space round the sun; and that, by its cooling, a portion of its atmosphere was condensed in water, which occupied a part of the surface. In this state, no forms of life, such as now belong to our system, could have inhabited it; and I suppose the crystalline rocks, or, as they are called by geologists, the *primary rocks*, which contain no vestiges of a former order of things, were the results of the first consolidation on its surface. Upon the further cooling, the water, which more or less had covered it, contracted; depositions took place, shell-fish and coral animals, of the first creation, began their labours; and islands appeared in the midst of the ocean, raised from the deep by the productive energies of millions of zoophytes. These islands soon became covered with vegetables, fitted to bear a high temperature, such as palms and various species of plants, similar to those which now exist in the hottest parts of the world. And the submarine rocks, or shores of these new formations of land, became covered by aquatic vegetables, on which various species of shell-fish and common fishes found their nourishment. The fluids of the globe in cooling, deposited a large quantity of the materials they held in solution, and these deposites agglutinating together the sand, the immense masses of coral rocks, and some of the remains of the shells and fishes found round the shores of the primitive lands, produced the first order of secondary rocks. As the temperature of the globe became lower, species of the oviparous reptiles were created to inhabit it;—and the turtle, crocodile, and various gigantic animals of the Sauri kind, seem to have haunted the bays and waters of the primitive lands. But, in this state of things, there was no order of events similar to the present;—the crust of the globe was exceedingly slender, and the source of fire a small distance from the surface. In consequence of contraction in one part of the mass, cavities were opened, which caused the entrance of water, and immense volcanic explosions took place, raising one part of the surface, depressing another, producing mountains, and causing new and extensive depositions from the primitive ocean. Changes of this kind must have been extremely frequent in the early epochas of nature; and the only living forms, of which the remains are found in the strata that are the monuments of these changes, are those of plants, fishes, birds, and oviparous reptiles, which seem most fitted to exist in such a war of the elements. When these revolutions became less frequent, and the globe became still more cooled, and the inequalities of its temperature preserved by the mountain chains, more perfect animals became its inhabitants, many of which, such as the mammoth, megalonix, megatherium, and gigantic hyæna, are now extinct. At this period, the temperature of the ocean seems to have been not much higher than it is at present, and the changes produced by occasional eruptions of it have left no consolidated rocks. Yet, one of these eruptions appears to have been of great extent, and some duration, and seems to have been the cause of those immense quantities of water-worn stones, gravel, and sand, which are usually called diluvian remains; and it is probable that this effect was connected with the elevation of a new continent in the southern hemisphere by volcanic fire. When the system of things became so permanent, that the tremendous revolutions depending upon the destruction of the equilibrium between the heating and cooling agencies were no longer to be dreaded, the creation of man took place; and, since that period, there has been little alteration in the physical circumstances of the globe. Volcanoes sometimes occasion the rise of new islands, portions of the old continents are constantly washed by rivers into the sea, but these changes are too insignificant to affect the destinies of man, or the nature of the physical circumstances of things. On the hypothesis that I have adopted, however, it must be remembered, that the present surface of the globe is merely a thin crust, surrounding a nucleus of fluid ignited matter; and, consequently, we can hardly be considered as actually safe from the danger of a catastrophe by fire."

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[*] Extracted from a posthumous work, entitled, "Consolations in Travel: or the Last Days of a Philosopher;" by Sir Humphry Davy, Bart. late President of the Royal Society of London,—in which views on various important topics are brought out in the form of dialogues.

Onuphrio said, " From the view you have taken, I conclude that you consider volcanic eruptions as owing to the central fire; indeed, their existence offers, I think, an argument for believing that the interior of the globe is fluid."

The *Stranger* answered, "I beg you to consider the views I have been developing as merely hypothetical,—one of the many resting places that may be taken by the imagination in considering this subject. There are, however, distinct facts in favour of the idea, that the interior of the globe has a higher temperature than the surface; the heat increasing in mines the deeper we penetrate; and the number of warm springs that rise from great depths, in almost all countries, are certainly favourable to the idea. The opinion, that volcanoes are owing to this general and simple cause, is, I think, likewise more agreeable to the analogies of things, than to suppose them dependent upon partial chemical changes, such as the action of air and water upon the combustible bases of the earths and alkalies, though it is extremely probable that these substances may exist beneath the surface, and may occasion some results of volcanic fire; and, on this subject, my notion may perhaps be more trusted, *as, for a long while, I thought volcanic eruptions were owing to chemical agencies of the newly discovered earths and alkalies; and I made many and some dangerous experiments, in the hope of confirming this notion, but in vain.*"

Ambrosio. "You are obliged to have recourse to creations for all the living beings in your philosophical romance: I do not see why you should not suppose creations or arrangements of dead matter by the same laws of infinite wisdom; and why our globe should not rise at once a divine work, fitted for all the objects of living and intelligent natures."

The *Stranger* replied, "I have merely attempted a philosophical history, founded upon the facts known respecting rocks and strata, and the remains they contain. I begin with what may be called a Creation, a fluid globe supplied with an immense atmosphere; and the series of phenomena which I imagine consequent to the creation, I suppose produced by powers impressed upon it by Omnipotence."

Ambrosio said, "There is this verisimilitude in your history, that it is not contradictory to the little we are informed by revelation as to the origin of the globe, the order produced in the chaotic state, and the succession of living forms generated in the days of creation, which may be what philosophers call 'the Epochas of Nature'; for a day with Omnipotence is as a thousand years, and a thousand years as one day."

"I must object," *Onuphrio* said, "to your interpretation of the scientific view of our friend; and to your disposition to blend them with the cosmogeny of Moses. Allowing the divine origin of the Book of Genesis, you must admit, that it was not intended to teach the Jews systems of philosophy; but the laws of life and morals; and a great man and an excellent christian raised his voice, two centuries ago, against this mode of applying, and of often wresting the sense of the Scriptures, to make them conformable to human fancies; 'from which,' says Lord Bacon, 'arose not only false and fantastical philosophies, but likewise heretical religions.' If the Scriptures are to be literally interpreted, and systems of science found in them, Galileo merited his persecution, and we ought still to believe that the sun turns round the earth."

Amb. "You mistake my view, *Onuphrio*, if you imagine I am desirous of aising a system of geology on the Book of Genesis. It cannot be doubted that the first man was created with a great variety of instinctive or inspired knowledge, which must have been likewise enjoyed by his descendants; and some of this knowledge could hardly fail to have related to the globe which he inhabited, and to the objects which surrounded him. It would have been impossible for the human mind to have embraced the mysteries of creation; or to have followed the history of the moving atoms, from their chaotic disorder into their arrangement in the visible universe; to have seen dead matter assuming the form of life and animation, and light and power arising out of death and sleep. The ideas, therefore, transmitted to, or presented by Moses, respecting the origin of the world and of man, were of the same simple kind, and such as suited the early state of society; but, though general and simple truths, they were divine truths, yet clothed in a language, and suited to the ideas, of a rude and uninstructed people. And yet, when I state my satisfaction in finding that they are not contradicted by the refined researches of modern geologists, I do not mean to deduce from them a system of science. I believe that light was the creation of an act of the divine will; but I do not mean to say that the words "Let there be light, and there was light," was orally spoken by the Deity; nor do I mean to imply, that the modern discoveries respecting light are at all connected from this sublime and magnificent passage."

Onu. "Having resided for a long time in Edinburgh, and having heard a great number of discussions on the theory of Dr Hutton, and having been exceedingly struck both by its simplicity and beauty, its harmony with existing facts, and the proof afforded to it by some beautiful chemical experiments, I do not feel disposed immediately to renounce it, for the views I have just heard explained."

The Unknown. "I have no objections to the Huttonian or Plutonic views, as capable of explaining many existing phenomena; indeed, you must be aware that I have myself had recourse to it. What I contend against, is its application to explain the formation of the secondary rocks, which I think clearly belong to an order of facts not at all embraced by it. The surface is constantly imagined to be disintegrated, destroyed, degraded, and washed into the bosom of the ocean by water, and as constantly consolidated, elevated, and regenerated by fire; and the ruins of the old form the foundations of the new world. It is supposed that there are always the same types, both of dead and living matter; that the remains of rocks, of vegetables and animals of one age, are found imbedded in rocks raised from the bottom of the ocean in another. Now, to support this view, not only the remains of living beings, which at present people the globe, might be expected to be found in the oldest secondary strata; but even those of the arts of man, the most powerful and the most populous of its inhabitants, which is well known not to be the case. On the contrary, each stratum of the secondary rocks contains remains of peculiar and mostly now unknown species of vegetables and animals. In those strata which are deepest, and which must consequently be supposed to be the earliest deposited, forms even of vegetable life are rare; shells and vegetable remains are found in the next order; the bones of fishes and oviparous reptiles exist in the following class: the remains of birds, with those of the same tribes mentioned before in the next order; those of quadrupeds of extinct species, in a still more recent class; and, it is only in the loose and slightly consolidated strata of gravel and sand, and which are usually called Diluvian Formations, that the remains of animals, such as now people the globe, are found, with others belonging to extinct species. But in none of these formations, whether called Secondary, Tertiary, or Diluvial, have the remains of man, or any of his works, been found. It is, I think, impossible to consider the organic remains found in any of the earlier secondary strata, the lias-limestone, and its congenerous formations, for instance, without being convinced, that the beings, whose organs they formed, belonged to an order of things entirely different from the present. Gigantic vegetables, more nearly allied to the palms of the equatorial countries than to any other plants, can only be imagined to have lived in a very high temperature; and the immense reptiles, the Megalosauri, with paddles instead of legs, and clothed in mail, in size equal or even superior to the whale; and the great amphibia, Plesiosauri, with bodies like turtles, but furnished with necks longer than their bodies, probably to enable them to feed on vegetables growing on the shallows of the primitive ocean, seem to shew a state in which low lands, or extensive shores, rose above an immense calm sea, and when there was no great mountain chains to produce inequalities of temperature, tempests, or storms. Were the surface of the earth now to be carried down into the depth of the ocean, or were some great revolution of the waters to cover the existing land, and it was again to be elevated by fire, covered by consolidated depositions of sand or mud, how entirely different would it be in its characters from any of the secondary strata; its great features would undoubtedly be the works of man; hewn stones, and statues of bronze and marble, and tools of iron, and human remains would be more common than those of the lower animals, on the greatest part of the surface; the columns of Pæstum and Agrigentum, or the immense iron and granite bridges of the Thames, would form a striking contrast to the bones of the crocodiles or sauri, in the older rocks, or even to those of the mammoth, or Elephas primogenus, in the diluvial strata. And, whoever dwells upon this subject must be convinced, that the present order of things, and the comparatively recent existence of man, as the master of the globe, is as certain as the destruction of a former and a different order, and the extinction of a number of living forms, which have now no types in being, and which have left their remains wonderful monuments of the revolutions of nature."

Onu. "I am not quite convinced by your arguments. Supposing the lands of New Holland were to be washed into the depth of the ocean, and to be raised according to the Huttonian view, as a secondary stratum, by subterraneous fire, they would contain the remains of both vegetables and animals entirely different from any found in the strata of the old continents; and, may not those peculiar formations to which you have referred, be, as it were, accidents of nature belonging to peculiar parts of the globe? And, you speak of a diluvian formation, which I conclude you would identify with that belonging to the catastrophe described in the sacred writings, in which no human remains are now found; now, you surely will not deny, that man existed at the time of this catastrophe; and he, consequently, may have existed at the period of the other revolutions, which are supposed to be produced, in the Huttonian views, by subterranean fire."

The Unknown. "I have made use of the term diluvian, because it has been adopted by geologists, but without meaning to identify the cause of the formations with the Deluge described in the sacred writings: I apply the term merely to signify loose and water-worn strata, not at all consolidated, and deposited by an inundation of water; and, in those countries which they have covered, man certainly did not exist. With respect to your argument derived from New Holland, it appears to me to be without weight. In a variety of climates, and in very distant parts of the globe, secondary strata, of the same order, are found, and they contain always the same kind of organic remains, which are entirely different from any of those now afforded by beings belonging to the existing order of things. The catastrophe which produced the secondary strata and diluvian deposition, could not have been local and partial phenomena, but must have extended over the whole, or a great part of the surface of the globe; the remains of similar shell fishes are found in the limestones of the old and new continents; the teeth of the mammoth are not uncommon in various parts of Europe; entire skeletons have been found in America, and even the skin covered with hair, and the entire body of one of these enormous extinct animals has been discovered in Siberia, preserved in a mass of ice. In the oldest secondary strata, there are no remains of such animals as now belong to the surface; and, in the rocks which may be regarded as more recently deposited, these remains occur but rarely, and with abundance of extinct species;—there seems, as it were, a gradual approach to the present system of things, and a succession of destructions and creations preparatory to the existence of man. It will be useless to push these arguments further. You must allow, that it is impossible to defend the proposition, that the present order of things is the ancient and constant order of nature, only modified by existing laws; and, consequently, the view which you have supported, must be abandoned. The monuments of extinct generations are as perfect as those of extinct nations; and, it would be more reasonable to suppose, that the pillars and temples of Palmyra were raised by the wandering Arabs of the desert, than to imagine that the vestiges of peculiar animated forms, in the strata beneath the surface, belonged to the early and infant families of the beings that at present inhabit it."

Onu. "I am convinced;—I shall push my arguments no farther, for I will not support the sophisms of that school, which supposes that living nature has undergone gradual changes, by the effects of its irritabilities and appetencies; that the fish has, in millions of generations, ripened into the quadruped, and the quadruped into man; and that the system of life, by its own inherent powers, has fitted itself to the physical changes in the system of the universe. To this absurd, vague, atheistical doctrine, I prefer even the dream of plastic powers: or that other more modern dream, that the secondary strata were *created*, filled with remains, as it were, of animal life, to confound the speculations of our geological reasoners."

The Unknown. "I am glad you have not retreated into the desert and defenceless wilderness of scepticism, or of false and feeble philosophy. I should not have thought it worth my while to have followed you there: I should as soon think of arguing with the peasant, who informs me, that the basaltic columns of Antrim or of Staffa were the works of human art, and raised by the giant Finmacoul."

Lectures on the History of the Natural Sciences. By Baron CUVIER *.

LECTURES FIRST AND SECOND.—*Earliest History of the Human Species.*

AFTER a statement of the motives which had induced him to undertake the task of publicly relating the history of the natural sciences, M. Cuvier spoke of the utility of this department of study. He then rapidly traced the progress of the sciences, from the most remote period to the present time, distinguishing three principal epochs; *the religious epoch, the philosophical epoch*, and, lastly, *the epoch of the division of labour*, which may be also named *the scientific epoch, properly so called.*

The first of these epochs comprehends the whole time during which science remained shut up in the temples, and was cultivated by the priests only, who concealed it from the vulgar, or only presented it to them under emblematical forms.

The second epoch commences at the time when the sciences, whose rudiments had been imported from Egypt, began, after a long interval, to be developed in Greece. From the moment of their revival, they assumed a new direction, separated themselves entirely from religion, and were no longer cultivated by the priests, but by philosophers, who communicated the fruit of their researches without reserve, and without disguise. The early Greek philosophers embraced the whole range of human knowledge, and each of them was at once a metaphysician, a moralist, a geometer, a naturalist, and a natural philosopher.

The third epoch was marked by the separation that was effected among the different departments of science. Each branch was cultivated by men who devoted themselves exclusively to it, directed the whole force of their minds towards it, and by this judicious distribution of labour, obtained a success unknown to their predecessors.

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* Of these highly interesting lectures, at present delivering in Paris, we shall in this and the succeeding Numbers give such a view as will interest our readers. The reports we now publish are held by some of our friends now attending these lectures to be correct.—EDIT.

It was no fault of Aristotle's that this epoch was so long in making its appearance. That great man, in fact, had assigned its natural limits to each department of science; but, unfortunately, he left no successor worthy of such a master, and the sect of Peripatetics, which he had formed, even fell into contempt in a few centuries. It was only after the long interval of the middle ages, and towards the commencement of the sixteenth century, that the change took place. Thus, the sciences have, as yet, been regularly cultivated only for three centuries.

After thus marking the characters of the three scientific epochs, the Professor reverted to the first, and, in endeavouring to determine its origin, was led to speak of the antiquity of human society. He shewed, that notwithstanding the paucity of the data which we possess on this question, we may yet arrive at some satisfactory results, by having recourse at the same time to history and geology, which severally present evidences corroborative of each other. Thus, while the traditions of all nations have preserved the remembrance of a great catastrophe, the *Deluge*, which changed the earth's surface, and destroyed nearly the whole of the human species, geology apprises us, that of the various revolutions which have agitated our globe, the last evidently corresponds to the period which is assigned to the deluge.

We say, that by means of geological considerations alone it is possible to determine the date of this great event with some degree of precision.

There are certain formations which must have commenced immediately after the last catastrophe, and which, from that period, have been continued up to the present day with great regularity. Such are the deposites of detritus observed at the mouths of rivers, the masses of rubbish which exist at the foot of mountains, and are formed of the fragments that fall from their summits and sides. These deposites receive a yearly increase, which it is possible to measure. Nothing therefore is more easy than to calculate the time which it has taken them to acquire their present dimensions. This calculation has been made with reference to the debris of mountains, and in all cases has indicated a period of about four thousand years. The same result has been obtained from the other alluvial deposites. In short, whatever may have been the natural phenomenon that has been interrogated, it has always been found to give evidence in accordance with that of tradition. The traditions themselves exhibit the most astonishing conformity. The Hebrew text of Genesis places the deluge in the year 2349 before Christ. The Indians make the fourth age of the world, that in which we now live, commence at the year 3012. The Chinese place it about the year 2384. Confucius, in fact, represents the first king Yao as occupied in drawing off the waters of the ocean, which had risen to the tops of the mountains, and in repairing the damage which they had caused.

Men assuredly did not begin to cultivate the sciences until long after this epoch. Astronomy is that of which traces are found at the most remote period, and it would seem to have originated in several countries at the same time. The first observation of an eclipse made by the Chinese, and of which the authenticity has been established, was in the year 776 A. C. At Babylon, the most ancient observation made by the Chaldeans was in the year 747 A. C. It has been said, indeed, that Callysthenes sent from Babylon to Aristotle a series of observations which comprehended a space of 1900 years; but this assertion, which first made its appearance in Synesius, a writer of the sixth century, deserves no trust. Aristotle, who speaks of astronomy in various parts of his works, would not have omitted so important a fact.

It has been supposed that in the zodiacs, painted on the walls of certain temples in Egypt, a proof was to be found that astronomy had been cultivated in that country from a very remote period. But whatever interpretation is given of these zodiacs, we have now, thanks to M. Champollion's discoveries, certain information respecting the antiquity of these temples; that of Denderah, in particular, was built in the reign of Tiberius, and bears the name of Nero. Another was built in the reign of Domitian. It may therefore be considered as sufficiently proved, that the sciences had not acquired any degree of improvement until the eighth century before the Christian era; notwithstanding great nations had been formed in several parts of the earth some centuries earlier. Fifteen hundred years before

Christ there were already four; the Indians, the Chinese, the Babylonians, and the Egyptians.

The Chinese having always kept themselves separate, the progress which they might have made could only benefit themselves, and could in no degree contribute to the general civilization. Thus, in the history of the sciences, they are never mentioned. As to the other three, so great a similarity is observed in their general doctrines, and in the emblems under which these doctrines are veiled, that they must evidently have had communication together.

The subject of metaphysics being the same for all nations, it will readily be conceived how several of them may have arrived separately at the same system of religious philosophy. It will also be conceived how they should have agreed in the choice of emblems, as these emblems are in general taken from among the natural bodies which men have more commonly around them. But how can the identity of political constitutions be accounted for, unless on the supposition of a communication. We know what is the organization of Indian society: it is at present precisely what it was before the Christian era. The people are divided into four principal castes. First come the Brahmins, the depositaries of science, and the ministers of religion; then the soldiers, those to whom exclusively the defence of the country was formerly intrusted. These men have the privilege of hearing the sacred books read. Then come the merchants, and lastly the artizans. In the two last castes, the different professions form so many hereditary subdivisions. This singular constitution, which could only have originated from a powerful genius, and which, before it could have been established among a single people, would have required the use of very extraordinary means, presents itself again in Egypt. Doubtless, no one will imagine that mere chance could have produced a coincidence of such a nature.

A similarity still more surprising, because manifesting itself in things of a more arbitrary nature, is that observed in the monuments of the three nations. The columnar architecture, it is true, might have originated at once in the artificial caves of Upper Egypt, and in the subterranean pagodas of India, since it were natural to think of supporting by pillars wrought in the rock the ceiling of these excavations; but in the edifices which rise above ground, similarity of form cannot be determined by the use of the same materials. In Assyria, in place of granite or syenite, brick alone was in use; and yet, from the little that remains to us of the religious monuments of that country, we see that their great architectural forms were the same as in India or Egypt.

The three nations had also a similarity in their geographical position, all of them having established themselves in the vicinity of great rivers, in countries where internal navigation was favoured by numerous natural canals. The history of the Indians discloses them to us at first in the great plains of the Ganges, and having only some colonies on the banks of the Indus,—the Babylonians settled in the delta of the Euphrates,—the Egyptians along the Nile. The three countries were in the route of an immense commerce, which religion covered with its protection. There was not, in fact, a sacred edifice among them, that had not a part intended for lodging merchandise, a kind of caravansera.

Although the mode of communication adopted during the whole of the religious period was by no means favourable to the progress of the human intellect, it is probable that the sciences, in the three countries that must be looked upon as their cradle, would have attained a high degree of perfection, had they not been repeatedly arrested by the irruption of barbarians.

The countries inhabited by the Babylonians, the Chinese, and the Indians, form a rich girdle around a vast region, composed for a great part of elevated sandy plains, adapted solely for pastoral tribes. These tribes can never arrive at the same degree of civilization as agricultural nations, and still less can they attain that of commercial nations; but they are sober, courageous, active, have little attachment to the soil, are eminently qualified for conquering, and are ready, whenever an enterprising chief presents himself, to rush in multitudinous bands upon their rich neighbours. History shews us in all ages the civilized nations sometimes repelling the pastoral nations, and sometimes subjugated by them. China has been repeatedly invaded and subdued by the Tartars, India by the Mongols, Babylonia by the Assyrians, and at a later period by the Persians.

Egypt was also repeatedly invaded by nomadic tribes. The first conquest is that called the conquest of the shepherd kings, about the year 1750 before Christ. They retained their conquest for two centuries. During this period, the order of the priests was entirely cast down, and the fountains of science dried up. The second irruption was that of the Medes and Persians under Cambyses. Posteriorly to our era, there came other nomadic tribes still—the Saracens, and, lastly, the Turks. We do not reckon the conquest at the time of Alexander, which was in fact far from being hostile to civilization, as the Greeks were at that time more advanced than the Egyptians.

The sciences, then, being in the east continually retarded by the irruptions of barbarians, were not placed in circumstances favourable to their development, until they had penetrated into the west, passing from the Egyptians to the Greeks, and from these latter to the rest of Europe. As to the Indians, they have not directly contributed to our civilization, and in fact it is only a very short time since any scientific communication has been established between their country and ours.

Yet it is in India, according to all appearance, that we are to look for the origin of the sciences. It is in that country, in fact, that the men who escaped from the deluge must have established themselves. The loftiest mountains of the globe, the chains of Himalaya and Thibet, would afford them an asylum, and the bases of these mountains would present them with the first cultivatable land. Babylonia could then have been nothing but marshes, and Egypt was yet under water. In fact, all the low part, as the priests told Herodotus, is a gift of the Nile. That river each year deposites a new layer of mud. By counting the number of superimposed layers, which are easily distinguished from each other, it may be seen how much the land rises in a given time; and in this manner we come by a very simple calculation to the result, *that, 2000 years before Christ, the whole of Lower Egypt had no existence.*

The priority of the Indians is further shewn by a tradition, to which no attention seems hitherto to have been paid. It is in fact in the extracts which have been preserved of the works of Manetho, that, in the reign of Amenophis, a king of the sixteenth dynasty, a colony came from India to settle in Ethiopia.

Now, Diodorus Siculus, and all those who have written on the religion of Egypt, derive that religion from Ethiopia, or Upper Nubia. Thebes itself was but an island, a colony of Meroe, which was the sacerdotal city of the Ethiopians. Thus, then, civilization came from India into Nubia, and from Nubia into Egypt. From the latter country it might even be traced to Babylon, since, according to Diodorus, the Chaldeans, who formed the sacred caste in Babylonia, were originally nothing but a colony of Egyptian priests.

We might naturally expect to find much information respecting the history of the sciences among the Indians, who were the first to cultivate them, and who, notwithstanding various conquests, have kept themselves so unaltered, that, at this very day, we find them just what Alexander found them. Yet among the Indians we hardly obtain any accounts of this nature. It is not that they have not written much, and that from the earliest times, but they do not possess a single historical book. Perhaps the Brahmins, to make their caste be held in more estimation, might have withheld the knowledge of the events which would have also borne testimony to the origin of the others. This at least is certain, that they hold it as a doctrinal point that history should not be written. The fourth age, say they, the age in which we live, is too miserable, all that takes place is too low, to be worthy of having the recollection of it perpetuated. The traces of the efforts of civilization have not therefore been preserved by them, and the only hope which we have, in the absence of annals, is that of deriving some indirect statements from their other books, or their monuments.

The monuments cannot afford us much assistance. Although they bear no date, it may be judged that they are posterior to the time of Alexander and the Ptolomies. If they had existed at that period, some Greek writers would not have failed to speak of them, as their gigantic proportions must have rendered them remarkable in all times. Besides, we can in some measure judge of their age by the emblems which are represented on them. These emblems all belong to the religion of the present day. Now, the mythological notions to which they refer are found developed only in treatises posterior to the Vedas, since the pantheism of the vedas is entirely metaphysical.

The temples which we know are therefore less ancient than the Vedas.

As to the vedas themselves, or sacred books written in Sanscrit, we know their age by means of a calendar which is found annexed to one of them, and which gives the position of the vernal equinox. Now, by means of the known laws of the precession of the equinoxes, we have been able to see in what year that calendar must have been closed. It ascends to 1500 years before Christ.

The vedas contain an exposition of the religious philosophy of the Indians. The oupavedas, which are of the same date, are composed of various scientific treatises on music, medicine, war, architecture, the mechanical arts, &c. These two works, as well as some very long poems, are written in Sanscrit, a language which is not at present spoken,—a language the most regular that is known, and which is especially remarkable for the circumstance that it contains the roots of the various languages of Europe, of the Greek, Latin, German and Sclavonic; so that, to find even the first instrument of science, namely, language, it would seem that we must go to the Indians in search of it. The astronomical part of the vedas contains few rules. Those which the Indians at present possess for calculating eclipses belong to much later treatises, and which all bear their respective dates. These treatises are in verse, and are learned by heart by the Brahmins of the astronomical caste.

It is well known that, in the last century, Bailly maintained that there had formerly existed in India a very advanced astronomy, of which the present astronomy is but a feeble remnant. His theory rested principally upon the circumstance, that the Indians possessed methods of calculating much more perfect than would seem compatible with the low state of the mathematics among them. Admitting the fact, what are we in strict logic to infer from it? That the Indians in former times were a little more advanced than they are at present. But this past time, perhaps, is not very remote. It might even be admitted, with M. Delambre, that the Indians have not invented the formulæ of calculation, but that they received them ready made from the Arabians. These formulæ are far from being so perfect as Bailly supposed; but their very defects have served to prove the falsity of the theory of which we speak. The Indians boast of possessing a long series of observations, which go back to the year 4000 before Christ, a period at which, according to them, there was a conjunction of all the planets. If they have actually observed this conjunction, we can, by means of calculation, confirm its reality. This it has been attempted to do. Now, it has been found that this conjunction did not exist; and it has been moreover discovered, that if, in the retrograde calculation, in place of making use of the correct formulæ which we now possess, we were to employ the defective formulæ of the Indians, he would arrive at an erroneous result, but at one which, for the epoch indicated, would give the appearance of a conjunction.

There results from these facts, and several others, which we owe to the researches of an English philosopher, that the ancient Indians had neither an astronomy of any degree of advancement, nor a regular geometry. As to the natural sciences, they must have possessed some slight knowledge of them, as their commerce, which was very flourishing, made a great variety of substances pass through their hands; but these sciences never made any considerable progress among them. Their being prevented from touching dead bodies, and the horror which they had of skins, must have placed an insurmountable barrier in their way. In short, all that the Indians could have communicated to the Egyptians, was their metaphysics, their mythology, and their constitution.

LECTURE THIRD.—*Egypt.*

Egypt presented circumstances highly favourable to the development of the sciences, of which it had received from India only an imperfect germ. From the extreme fertility of its territory, the inhabitants had abundant leisure to devote to study, and being condemned to inactivity during the time the river kept them pent up in their towns, they could not fail to be inclined to meditation.

The inundation itself, by giving the Egyptians wants unknown to other nations, induced an activity of mind, and led them to a multitude of useful discoveries. The necessity of retracing the boundaries of properties, after the river had retired into its bed, led them to invent surveying, and the desire of facilitating the flowing off of the waters, taught them the art of digging canals. They seem to have paid early attention to the study of the celestial phenomena, which alone could afford them the means of foreseeing the motions of the Nile; and as the extreme purity of the atmosphere was favourable to this study, they made more progress in astronomy than any other nation.

The Egyptians made great progress in architecture also, for having been induced by circumstances, of which we shall presently speak, to employ a great portion of their riches in building, they had excellent materials in abundance, which the river permitted them to transport with ease.

Religion was not in Egypt, as it was in India, an obstacle to the progress of the natural sciences. On the contrary, it imposed in some measure an obligation to cultivate them; and, in fact, not only did it borrow many of its emblems from the animal kingdom, but it also necessarily excited attention to all those animals which it had pronounced to be sacred.

This part of the Egyptian religion did not come from India, but originated in Ethiopia. It is probable that the Ethiopians, before the arrival of the Indian colony, had been addicted to fetishism, as are in general all the tribes of the negro race, and that they would not adopt the new religion without mingling with it a part of their old superstitions. But in whatever manner this religion was established, it is certain the priest attached at least one animal to each divinity. The hawk was consecrated to Osiris, the ibis or the cow to Isis, the crocodile to Saturn. In each of the temples in which these divinities were worshipped, there were brought up several of the animals which were dedicated to them, and which themselves in some measure shared in the divine honours paid to their patrons. There were thus afforded constant opportunities of observing their external forms and their habits. There were even occasions of observing their internal structure, as it was customary to embalm them after death.

In Egypt the same horror toward dead bodies was not entertained as in India; not only were the bodies of sacred animals embalmed, but those of men also. Now, this practice could not fail to give those who were charged with it a knowledge of the form and position of the organs. It was undoubtedly in Egypt that anatomy originated; it was to that country that the Greeks resorted to study it; and thither Galen made a journey expressly for the purpose of seeing the representation in bronze of a human skeleton.

This much in respect to the observations on animals; as to minerals, they in some measure presented themselves to observation, being in Egypt not deeply buried, as in most other countries. They were known not only by their external characters, but also by what we at the present day call their chemical characters; and we may here remark, that the name Chemistry itself comes from the word *chim*, which was the ancient name of Egypt. As to what was afterwards called the Egyptian science, the Hermetic art, the art of transmuting metals, it was a mere reverie of the middle ages, utterly unknown to antiquity. The pretended books of Hermes are evidently supposititious, and were written by the Greeks of the lower Empire.

All the books of the Egyptians are lost; and thus, in pursuing the history of the sciences among them, we have perhaps fewer resources than in tracing it among the Indians. There remains a catalogue of the sacred books of Hermes, which Clement of Alexandria has preserved in the sixth book of his *Stromata.* The books of Hermes were held in great veneration in Egypt. They were carried in procession in the religious solemnities, and every priest was obliged to have by heart at least the part which related to the attributes of his order. These books treated of religion, the arts, medicine, and several other sciences; but it is remarkable that they did not speak of history, whence it would appear, that the Egyptian priests had the same repugnance as the Brahmins to preserve by writing the remembrance of the events of which their country had been the theatre. We have therefore no annals of Egypt; but we have several lists of their kings preserved by Eusebius and other writers. These lists do not agree well together. They may, however, be useful for being consulted, provided the cause be not forgotten which probably introduced into them the confusion they exhibit; for it would appear, that in ancient times Egypt was divided into independent states. The names of the sovereigns of all these small kingdoms have been handed down to us; but, instead of presenting them in linear series, the writers have placed them in the same line, as if there had been a regular succession. This mistake has greatly contributed to mislead several modern writers, and to induce them to refer to a very remote epoch the origin of the Egyptian nation.

The conquest of the shepherd kings abolished all the little principalities, and subjected Egypt to a single domination. After the expulsion of the conquerors, the victorious dynasty became in its turn sole master, and thenceforward the union became definitive. It was by this union that the Egyptian nation became really powerful, and it was after this period alone, that it could undertake great works. The recent discoveries of M. Champollion have afforded us an undeniable proof of this. Having found means of reading the names of the sovereigns inscribed in hieroglyphic characters upon the monuments, he has found none anterior to the seventeenth and eighteenth dynasties, that is, to those which expelled the nomadic conquerors; and it is probable that most of the edifices which bear the names of these princes, and which appear to have been raised in honour of them, were not built until long after their death.

As, in the deficiency of books, we rest our hopes of obtaining some documents upon the monuments, it is of importance to determine their age, at least in a relative manner. This may be done by comparing the style of their architecture, which, simple and rude in the more ancient times, acquires elegance as we approach those more modern.

The pyramids, which, however ostentatious, evidently belong to the infancy of art, are certainly anterior to the columnar edifices, and those possessed of elegant proportions. Now, these pyramids, even by Manetho's account, were not built until after the reign of Sesostris, the vanquisher of the shepherds. This much is certain, that they did not exist at the time of the Jewish migration, for the Scriptures make no mention of them. It would even seem that, at this period, the Egyptians used brick in their public buildings, as they employed the Jews in manufacturing them in enormous quantities. Nor did the pyramids exist at the time of the migration of Cecrops and Danaus, as the Greeks never imitated their form. The first allusion to the splendid edifices of Egypt occurs in Homer, who speaks of the hundred-gated Thebes, and who, without doubt, by this expression meant the gigantic propylæi placed in the front of temples, of which that city, in fact, contained a great number.

Most of the edifices which we know must have been built from the year 1000 before Christ to the year 550, the epoch of the invasion of the Persians. In fact, this was the period at which Egypt enjoyed her greatest prosperity. An exaggerated idea, however, would be formed of the power of that country, were we to judge of it only by the number and magnificence of the monuments which have been left to us. It must be remembered that there had been a gradual accumulation of them for ages; for, in a climate always equable, edifices built of granite endure until they are purposely overturned. It ought also to be remembered, that Egypt, from her position mistress of the commerce of Africa, must have acquired immense riches, and that all these riches must have been employed in the valley of the Nile, since beyond it there was nothing but sand. Being unable, therefore, to enlarge her territory, she covered it with palaces. A similar concurrence of circumstances produced the same results at Palmyra. Palmyra is an oasis of verdure placed in the midst of the desert. It had no other advantage than that of possessing some springs, but this was enough to induce the caravans which went from the Euphrates to the Mediterranean to pass that way. These caravans came laden with the valuable productions of the East; and during their short abode in the oasis, they left much gold, of which the inhabitants could have made no use, had they not employed the greater part for raising temples and palaces.

In modern times, Genoa, enriched in the same manner by commerce, and restricted in her territory by the sea and the Appenines, has reproduced, in some degree, the wonders of Palmyra and Egypt.

Egypt, during the whole time of her prosperity, remained shut to strangers; but towards the sixth century before our era, troubles having arisen, and having brought on a civil war, the weaker party sought support in foreign countries, and Psammeticus first brought auxiliary troops from Asia Minor. It was then only that the Greeks could profit by the advances which the Egyptians had made; and that Thales and Pythagoras, and perhaps several other sages whose names have not been preserved, went to be instructed in the school of the priests.

To judge of what the Greeks must have gained by this communication, it is necessary to know what was at this period the state of knowledge in Egypt. Let us, in the first place, look to the mathematical sciences.

It is certain that the Egyptians had a knowledge of hydraulics, as they were expert in the art of digging canals; that they had ideas of mechanics, since, without very powerful machines, it would have been impossible for them to erect obelisks, and to raise the enormous blocks which some of their monuments present. It is certain that they had tolerably perfect modes of procedure in stereometry, of which a proof is given in the cutting of the stones of their buildings. We know, further, that they were good surveyors. All this would lead us to believe that they were pretty well advanced in the mathematical theories. But, on the other hand, if it be true that it was only after his travels that Pythagoras discovered the theorem of the square of the hypothenuse, it must be admitted that the geometry of the Egyptians was still in its infancy, or, at least, that it was purely practical.

At the period when the first migrations were made to Greece, astronomy was very little advanced in Egypt, as the lunar year alone was known. But as this science, as we have said, was very necessary to the Egyptians, they devoted themselves to it with great application, and made rapid progress in it; so that, when a communication was re-established with the Greeks, in the reign of Psammeticus, they had already adopted the solar year of 365 complete days. Soon after, they made the addition of a fourth of a day, and thus came much nearer the true duration. This reformed solar year was employed for civil uses. As to the religious year, having been regulated at an earlier period, it remained with its 365 complete days, without its being allowed to change it. It happened, in consequence, that the festivals were gradually displaced—that they no longer corresponded to the same sideral epochs as at the time when they were instituted—and that, to return to them, they required to pass through all the seasons in succession. This period, at the end of which every thing was restored to the original order, was what the Egyptians named the Great Year, or the Year of Syrius.

It is probable that it was only from the heliacal rising and setting of the principal stars that the Egyptians succeeded in thus approximatively determining the length of the year; for their means of observation were very imperfect, and it is not believed that they had any other instrument than the gnomon for measuring the heights of the sun.

We might be inclined to think that the Egyptians were very little advanced in general physics, were it true that they considered fire as an animal which devoured the bodies that were presented to it; but, perhaps, this was only the opinion of the vulgar, and not that of the learned.

The Egyptians had very correct ideas on several points in geology; they had well observed the laws of alluvial deposition, and at the present day we account for the formation of the Delta in no other manner than that in which it was accounted for in the days of Herodotus. They had discovered the existence of solids not only in the alluvial formations, but also in rocks. Thus, it may be thought, that when Thales in Greece declared water to be the first principle of all things, he only gave a new form to the theories of the Egyptian priests, who alleged that the earth had arisen from the waters.

The properties of minerals were tolerably well examined. The country offered every facility for this; the mountains which form the sides of the valley of the Nile exhibited, and in all their native lustre, various species of rocks; in the lower part limestone, farther up sandstone, and towards Syene porphyry and granite. Egypt was in some measure a great mineralogical cabinet. The necessity of passing along the small valleys which run towards the Red Sea, led to the discovery of other minerals which do not occur in so great masses. It was in one of them that the mine of emeralds was discovered, which supplied all those known to antiquity.

The manner in which the Egyptians wrought fine stones, porphyry and granite, shows that they had the use of very sharp instruments, and that they consequently were well acquainted with the art of tempering. Very little iron, it is true, has been found in their cities and tombs; but this depends upon the circumstance that that metal is easily destroyed. Besides, various other metals have been found in them, and, among others, bronze, and gold of great purity. They were acquainted with all our enamels and porcelains; they knew how to make up the most brilliant and the most solid colours, and even ultramarine; in a word, they were infinitely more advanced in the chemical arts than the Greeks and Romans ever were.

We have said that the habit of rearing sacred animals in the temples, would have enabled the Egyptians to study the manners of these animals, and to observe their forms with care; and, accordingly, they reproduced them with perfect fidelity in painting and in sculpture. We find on their monuments more than fifty species of animals, so recognisable, that even when the figures are of small dimensions and merely given in outline, it is impossible to mistake them. Thus we distinguish in their sculptures the great antelope, the oryx, the giraffe, the large-eared hare, the sparrow-hawk, the vulture, the Egyptian goose, the quail, the lapwing, the ibis, &c. Gau, in his work on Nubia, has given a copy of a painting which represents the triumph of an Egyptian monarch. There are seen in it the different nations offering to the conqueror animals peculiar to their respective countries. There are distinguished in it the hunting-tiger, an animal which we have only known in Europe for about thirty years back, the aspic, *coluber haje*, the crocodile, &c. Although in these representations the zoological characters have not been expressed, yet the general aspect is so well exhibited, that a naturalist can always readily make out the animal, even in the case of insects and fishes. In a painting brought to France by M. Caillaud, and which represents people fishing, there occur more than twenty distinct species of fishes; siluri, cyprini, and other species of singular form and peculiar to Egypt, all so faithfully expressed, that one can recognize them at first sight.

It cannot be imagined that a nation which devoted itself with so much perseverance and success to the observation of nature, should have confined itself to the mere collecting of facts, without attempting to connect them by theories, and to ascend to principles. It must, therefore, be supposed, that there was at a certain epoch in the colleges of the priests, the knowledge not only of philosophical and religious doctrines, but also that of particular scientific theories. These theories doubtless have been lost in consequence of the oppression to which the sacerdotal caste was subjected at the time of the conquest of Cambyses.

The leaders of the colonies which issued from Egypt, possessed in general but a small part of the knowledge of which this privileged caste was the depository. They carried with them only the practical results. The case was different with the Hebrew legislator. He had been brought up by the Egyptian priests, and knew not only their arts, but also their philosophical doctrines. His books shew us that he had very perfect ideas respecting several of the highest questions of natural philosophy. His cosmogony especially, considered in a purely scientific point of view, is extremely remarkable, inasmuch as the order which it assigns to the different epochs of creation, is precisely the same as that which has been deduced from geological considerations. According to Genesis, after the earth and the heavens had been formed and animated by light, the aquatic animals were created, then plants, then terrestrial animals, and last of all man. Now this is precisely what geology teaches us. In the deposites which have been first consolidated, and which, consequently are the deepest seated, there occur no organic remains; the earth, then, was therefore without inhabitants. In proportion as we approach the upper strata, we find appearing at first shells and remains of fishes, then remains of large reptiles, then bones of quadrupeds. As to the bones of the human race, they are met with only in alluvial deposites, in caves and in the fissures of rocks; which shows that man made his appearance upon the earth after all the other classes of animals.

LECTURE FOURTH.—GREECE.

The Greeks did not receive the whole of their knowledge from Egypt. They had communications with the Phenicians, and probably also with the Babylonians, as well as assuredly with the tribes of Colchis and Caucasus, from which latter they received religious rites, that differed greatly from those of the Egyptians. But, with respect to the result of all these early communications, we are reduced to mere conjectures, and can only hope for accounts possessing any degree of accuracy, from the period when Cadmus carried the Phenician alphabet into Greece. From this epoch we have an unbroken chain, and the history of the sciences is based upon a continuous series of written documents.

The sciences, once introduced among the Greeks, were there free of the fetters which had retarded their progress among the other three nations, whose history we have sketched: they had no longer to suffer from the irruptions of barbarians, nor from the interests of a privileged class.

India, Assyria, and Egypt were, as we have said, countries quite open, and which, from the very nature of their ground, were incapable of being defended. This was not the case with Greece, of which the whole central part being mountainous, offered great facilities for resisting an invasion. There each tribe, separated from the others by deep valleys and passes, found natural ramparts in its rocks. An invader would have to conquer the land foot by foot, and the parts which he had subjected would speedily withdraw themselves from his domination. All the small islands connected with this country were, in like manner, defended by their mere position, and were enabled to preserve their independence. Accordingly, Greece could never long remain united under the same laws; and perhaps these circumstances, which depend upon the natural configuration of the country, will, even in our time, render the establishment of a central government extremely difficult.

The settlements which the Greeks made on the coast of Asia Minor and Italy were not, it is true, so easily defended; but when they were overrun, the learned men who had sprung up there betook themselves to central Greece, and carried to it the tribute of their knowledge; so that the conquest of the colonies, far from retarding the civilization of the mother country, only served to advance it.

Mythological forms were, in the East, only the emblematic expression of a system of general philosophy, and thus the priests were at the same time the learned men of the nation

In Greece, the external forms of religion only were received, without, however, any understanding of the meaning concealed under these emblems, so that the priests there were not in general more learned than the vulgar. They did not form a caste, for, although in the beginning, there had been a tendency to perpetuate the priestly dignity in the same families, this scheme was acted on within very narrow limits, and could therefore exercise but a feeble influence upon the constitution.

The sciences, therefore, at their revival in Greece, were completely separated from religion, and consequently free in their progress; while, in the countries in which a divine origin was attributed to them, they necessarily remained stationary, as no one, without being guilty of sacrilege, could change in any respect a doctrine which had emanated from the Divinity itself.

Epochs of the History of the Sciences in Greece.—The history of the sciences in ancient Greece presents four distinct epochs. The first commences with the establishment of the Pelasgi in that country, and terminates with the arrival of the Egyptian colonies, about the fourteenth or fifteenth century before our era. The second comprehends all the time that elapsed between the arrival of these Egyptians and the settlement of the Greek colonies upon the coast of Asia Minor, about the year 1100 before Christ. The third extends from the establishment of these colonies to the time when the communications with Egypt were revived, about the year 600 before Christ. The fourth epoch commences with the journey of Thales to Egypt, and comprises the most brilliant age of Greece.

Were we to refer to some writers of the Alexandrian school, we might suppose ourselves possessed of a very exact history of ancient Greece. We have genealogies of the kings who reigned in that country, with quite as many details as those of the sovereign houses of Europe; but these genealogies, in which there always figure at the head some mythological personages, such as Jupiter or Neptune, are evidently not authentic. Thus, the history of the Greeks, before the time when Cadmus brought them the art of writing, is entirely conjectural. All that we know is, that, previous to the arrival of that chief, the Pelasgi were not entirely in a barbarous state, and that they were already acquainted with several arts.

The Pelasgi were originally from India, of which the Sanscrit roots that occur abundantly in their language do not permit us to doubt. It is probable, that, by crossing the mountains of Persia, they penetrated as far as the Caucasus; and that from this point, instead of continuing their route by land they embarked on the Black Sea, and made a descent upon the coasts of Greece. They founded several cities in that country, and there are still found in the places where they first settled, Thyrintum, Mycene, &c., remains of their buildings, known by the name of Cyclopean Walls. In the time of Pausanius, it was already known that these buildings were anterior to the arrival of the Egyptian colonies, and that to the labours of the Pelasgi were owing certain gigantic works, such as the treasuries of Minias, and the canals dug through Mount Ptöus, to afford an issue to the waters of the lake Copaïs, and prevent the inundation of Bœotia.

The religion of the first Pelasgi was much more simple than that of the Greeks. It was probably confined to the deification of certain powers of nature, and their representation under sensible forms.

The disturbances which took place in Egypt about the fourteenth and fifteenth centuries before our era, caused various emigrations. Those which directed themselves towards Greece were pretty numerous. The best known are those of Cecrops, Danaus, and Cadmus. Cecrops, in the year 1556 before Christ, carried into Attica the mysteries of Isis or Ceres; Danaus, in 1485, brought over the thesmophories; and Cadmus, in 1493, imported the alphabet, whose oriental origin is sufficiently indicated by the form of the letters and the name which they have preserved. The colonies arrived with sufficient strength to establish themselves in the country of the Pelasgi, and diffuse their civilization there. But, as we have said, their chiefs had only been half-instructed in the science of Egypt, so that they only brought over the external form of the religion, without connecting with it any metaphysical idea. Their divinities, although evidently borrowed from the Egyptian mythology, henceforth appeared only under purely human forms, and this very anthropomorphism was favourable to the progress of the graphic arts. What in fact would sculpture have become, had it been confined to the hideous forms of those emblematical beings in which the priests had personified one of the attributes of the Divinity, had it been forced to represent a god with four heads and an hundred hands, as in India, or with the head of a wolf or a hawk, as in Egypt?

A particular tribe, the Hellenes, which extended its rule not only over the Pelasgi, but also over the foreign colonies settled in Greece, ultimately gave its name to the whole country. This tribe, which, under the guidance of Deucalion, settled in the neighbourhood of Parnassus, came from the north, and probably from Caucasus, as it was on that mountain that the poets represented Deucalion's father, Prometheus, as chained. Now, the tribes of the Caucasus were certainly acquainted with the doctrines of India through their connections with Colchis, which was long, in a manner, the factory of their commerce in the European seas. The Hellenes were the earliest civilized of all the nations of Greece. It is to them that we owe the worship of Apollo and the introduction of the arts.

The Greek religion, at the commencement, partook of its Indian and Egyptian origin. The island of Samothrace, in which were established the most ancient mysteries, had divinities whose significative names still indicate the metaphysical ideas which were connected with them. In Thrace, the part of the continent in the neighbourhood of this isle, Orpheus, instituted religious forms which resemble those of the east. The influence of Cecrops, however, prevailed, and pure anthropomorphism was established. This Orpheus was a priest and a poet at the same time. There are attributed to him a collection of hymns, and some works, in which there occur details respecting plants and stones, but only considered with reference to theurgy. Nearly, at the same epoch, Chiron, it is said, already studied their properties for the purpose of applying them to medicine.

Chiron and Orpheus are reckoned among the heroes who, under the name of *Argonautæ*, went to Colchis to conquer the Golden fleece. It is probable that this expedition is not the representation of a single fact, but rather the expression of the commerce which was established by the way of the Black Sea with the nations of the Caucasus. Even Orpheus and Chiron might be merely the poetical representation of the first efforts for the cultivation of the necessary arts. Be this as it may, real advances were made by the family of the Asclepiadæ, which ascends nearly to this period, that is to say about 1300 years before Christ.

A century after, the famous Trojan war took place, in which the Europeans contended against the Asiatics. The poems of Homer, written about the year 950, that is about 200 years after the event, shew us, that at this period the arts had made considerable progress. The metals were forged and tempered; arms chased and gilded; cloths woven and dyed with the most brilliant colours. Sculpture and painting had also been invented.

The Iliad and Odyssey contain some moral maxims; but there are no traces in them of a philosophical doctrine, nor even of a religious doctrine properly so called. The gods are only men, stronger and more beautiful, but still vulnerable, and differing from other men only in having the faculty of concealing themselves from view, and of rising in the air.

The comparisons with natural objects which occur so frequently in the verses of Homer, shew, that at this period very accurate observations had been made on the manners of animals. When that poet compares a hero pursued by common warriors to a lion assailed by jackals, the picture which he draws of the habits of the latter animals is as correct as brilliant.

Hesiod may be considered as the contemporary of Homer, for his two works bear the seal of the same epoch. In his Theogony, we see mythological anthropomorphism in all its purity; some faint traces of pantheism appear in the history of the giants and Titans. In his book of *Days and Hours*, Hesiod inculcates upon men the necessity of labour, and gives some rules for their guidance. He speaks of the culture of corn, the time of tilling and sowing, &c. It is to be remarked that he always indicates the time proper for these operations by the heliacal rising of a star, which proves, that if the lunar year was already established in Greece, it was, at least, little used in domestic life, its mode of division necessarily rendering it inconvenient. Hesiod, in his book, names a certain number of plants, and points out their properties.

Such, in the ninth century before our era, was the state of knowledge in Greece.

It was during the time which elapsed between the Trojan war and the birth of Homer and Hesiod, that the colonies which migrated to the coast of Asia Minor set out. Their emigration was produced in consequence of the revolutions which took place in Greece, when the Heraclidæ made the conquest of the Peloponnesus. Ionians, Dorians, and Eolians, left their country, and went to found, in Asia, a great number of cities, some of which, such as Smyrna, Ephesus, and Miletum, soon acquired a high importance.

When there were Greek settlements on both sides of the Egean Sea, the frequent communications which were established between them, gave a new impulse to commerce, and presently caused the riches of the east to flow in. The new cities were soon in a state to send out colonies themselves, and several bands from them went to settle on the shores of the Black Sea.

A little more than two centuries after the conquest of the Peloponnesus by the Heraclidæ, Greece was agitated by fresh troubles, the result of which was the almost universal abolition of royalty. This revolution gave rise to a new emigration, which, this time, taking a direction opposite to the first, settled upon the shores of Italy, in the country which afterwards bore the name of Magna Græcia. These Italian colonies, which soon became extremely rich and polished, were an additional means of civilization to central Greece.

We now come to an epoch marked by two events which had a great influence upon the progress of the sciences. The first is the re-establishment of the communications with Egypt, which took place when Psammeticus took Greeks from Asia Minor into his armies, as auxiliaries: the other is the war of the Persians against the Greeks, the conquest of the colonies of Asia Minor, and the invasion of central Greece itself, an attempt which fortunately was not crowned with success.

About 600 years before Christ, Cyrus possessed himself of Media. His son Cambyses carried his arms toward Egypt, subjected the whole of that country, and reduced the priests to a state of great degradation. The effects of conquests of this kind are commonly rendered less rigorous, because the victors, yielding to the ascendency of civilization, adopt the manners and customs of the vanquished. In Egypt, such a union could not take place. The Persians, whose religion rested upon the doctrine of the two principles, were in this respect evidently superior to the Egyptians, and they moreover held the religion of that people in abhorrence, on account of the honours which they rendered to images. They therefore persecuted them cruelly.

The same reasons rendered their yoke heavy upon the Greek colonies of Asia Minor, when Cambyses's successor Darius conquered them. Oppression there arrested the progress of the arts and of poetry, as in Egypt it had stifled the philosophical and religious doctrines. The conquest of Darius threw upon central Greece a multitude of emigrants, who carried there the knowledge which they had acquired in Egypt; for, as soon as the gates of that country had been opened by Psammeticus, Thales, Pythagoras, and several other sages, hastened thither to be instructed in the school of the Egyptian priests. It may therefore be said, that if the successes of the Persians disquieted Greece, so far from retarding its progress toward civilization, they even contributed to accelerate it.

Xerxes, who reigned after Darius, attacked central Greece; but he was repulsed: and it is at this time that the most brilliant epoch of that country commences. In fact, philosophy, cultivated at first in the colonies of Asia Minor, and then in the Italian colonies, at length concentrated itself at Athens, and there, in a few years, arrived at a high degree of perfection.

The Greek philosophy did not originate from a single stem. It did not possess uniformity, because it was not confided to a single learned body. It was derived, it is true, by different channels, from the ancient Egyptian philosophy; but the sages who went to drink at this source, each in his own manner, modified the doctrines which were communicated to them, and formed different schools.

(To be continued.)

On the Heights of the most remarkable Summits of the Cordillera of the Andes in Peru.

To know the highest summit in every chain of mountains, the highest mountain in every country, in every continent, in the whole world, has always been a favourite object with mankind. Astronomical observations have permitted this research to be extended even to the Moon, to Mercury and Venus. These planets have been studied of late with so much care, and with instruments so powerful, that it seems difficult to determine more precisely than has already been done, the height of the prodigious mountains which cover their surface. The asperities of the Earth have also been the objects of constant research. The number of points whose several heights above the level of the sea, are irrevocably fixed, is very considerable; and yet, not to mention countries which geographers have never yet explored, it would be difficult to say with certainty, even of the Himalaya, Caucasus, the American ranges, and even of some chains in Europe, whether their culminating points have been accurately measured. Not but that the traveller may have, in every place, directed his attention to the summits which *appeared to him* the highest; but unfortunately such appearances are often deceitful, and bad substitutes for real measurements. The circumstance of a mountain being more or less isolated, the inclination of its sides, its distance, the form, disposition and height of the surrounding grounds, and finally the state of the atmosphere, are so many causes of fallacy, from which the most experienced observer cannot get free, and which are removed only by the barometer and geodesical instruments. Were it necessary to adduce examples in support of these reflections, many might be quoted. Thus we might say that, at the beginning of the eighteenth century, the Peak of Teneriffe was reckoned the highest mountain in the world *, though, in the Alps of Switzerland, there were summits which surpass it nearly one-third; though many travellers had, on their return from Peru, seen the great Cordillera of the Andes, and even visited some of the populous towns that are situated on their table-lands, whose height is far superior to that of the Peak. We might also remark, that the Pyrenees had been traversed by learned academicians, supplied with powerful instruments, and that they still gave out that Canigou was the highest top in the chain; whereas we now know, that not only Malahite, Mount Perdu, the Cylindre, &c. surpass it by 1968 feet; but also that, at a short distance from this mountain, within the same limits of the department of the Eastern Pyrenees, there are summits which, according to the late observations of M. Coraboeuf, exceed it in height nearly 460 feet. We need not be astonished then, if, from time to time, certain peaks descend from the rank, as to height, which was once assigned them. Mont Blanc itself, so long in possession of the first place in the system of European mountains, came to lose it afterwards, from an imperfect measurement of the summits of Mount Rose. Now Chimborazo has, in its turn, to lose its pre-eminence. This mountain, so celebrated in the works of Bouguer, of La Condamine, and above all in those of M. Humboldt, is not the highest in the world, as has been supposed for so many years *. It is not even the highest summit of the Cordilleras.

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* See the Geography of Varenius, reviewed by Newton.

Mr Pentland, an active and enterprizing naturalist, who was attached to the Peruvian embassy, was induced, by the love of science, to solicit a mission into Upper Peru, a region hitherto but little explored. During his journey he attended particularly to the heights of the mountains, and found that their elevation much exceeded what was generally supposed.

The great mass of the Andes, from 14° to 20° south latitude, according to Mr Pentland, is divided into two chains or parallel cordilleras, between which there is a very extensive elevated valley. The south extremity of this valley is traversed by the river *Desaguadero*; to the north is the famous Lake of Titicaca, of an extent equal to twenty-five times that of the Lake of Geneva. This great valley forms a kind of table-land, the most elevated on the globe, except Thibet; but, while Thibet presents only ranges of mountain pasture, covered with herds of sheep, this table-land of the New World supports cities above the regions of the clouds, even higher than the snow-covered pinnacle of the Jungfrau; post stations higher than the summit of Mont Blanc; while its plains are covered with harvests of maize, rye, barley, and even of wheat. The banks of the Titicaca formed the central part of the kingdom of the Incas. It is in one of the islands of this lake that Manco Capac was born. It is there that we find the finest remains of the monuments that were erected by the Peruvians, during the time of their ancient civilization. The western Cordillera, that which, in the language of the country, is called the "Cordillera of the West," separates the Valley of Desaguadero, the Thibet of the New World, as Mr Pentland calls it, and the basin of the Lake of Titicaca, from the shores of the Pacific. This chain contains many active volcanoes, such as those of Sehama, Arequipa, &c.

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* This has been proved already by the heights in the Himalaya range.

The eastern Cordillera separates the same valley from the vast plains of the *Chiquitos* and Moxos, and the declivities of the rivers Beni, Mamore and Paraguay, which fall into the Atlantic Ocean, from those of Desaguadero, and the lake of Titicaca. This eastern Cordillera is confined within the limits of the new republic of *Bolivia*. The Illimani and the Sorata, the two loftiest summits measured by Mr Pentland, are situated in this range. They not only surpass Chimborazo, but even approach in height to the principal summits of the Himalayas.

Mr Pentland not being able to reach the top either of Illimani or Sorata, on account of the immense glaciers which covered their sides, measured their heights by means of trigonometrical operations.

In measuring Illimani, the triangles were made to rest on a base measured along the side of a lake, situated at the very foot of a mountain, and whose height above the level of the sea was determined barometrically. The angles of elevation exceeded 20°.

The height of Sorata is grounded upon an operation which was carried on along the banks of the Lake Titicaca; but this operation having made it appear only how far the top of the mountain rises above the line, marking the inferior limit of the perpetual snows, it was necessary, in order to get the real height, to borrow the vertical co-ordinate of the snows, at other points of the same chain, where an immediate measure was possible. Thus we see that the height of Sorata has been obtained less directly than that of Illimani. Mr Pentland is sure that, if any errors exist, they must be very trifling, or at least errors which cannot be called gross. If, then, we except three or four points among those which are marked in the following tables, all the other determinations of heights are the result of barometric measures, frequently repeated with the excellent instruments of M. Fortin.

Heights of Mountains in Upper Peru, above the Level of the Sea[*].

Eastern Cordillera.

	Feet.
1. *Nevado di Sorata,*	25,250
It is the loftiest summit in this range, and is considerably higher than the former loftiest summit of the New World, Chimborazo, which is only 21,425 feet above the sea.	
2. *Nevado di Illimani,* which is situated to the eastward of the city of La Paz, is	24,350
3. *Cerro de Potosi,*	16,037
This is the famous metalliferous mountain, which gives name to the neighbouring city. The highest point where mines are worked in the Cerro de Potosi, is	15,912

Western Cordillera.

1. Mountain of Tajora, or Chipicani,	18,898
2. Mountain of Pichu.—Pichu, composed of trachite,	18,603
3. Volcano of Arequipa,	18,373
This is the most perfect and picturesque volcanic cone in the whole range of the Andes.	

Passes (Cols) of the two Cordilleras.

Pass of Atlos de los Huessos, is	13,605
This pass is on the southern base of the volcano of Arequipa. The name is from the circumstance of its being strewed over with numerous bones of beasts of burthen, who have perished during the journey: Huessos, in Spanish, signifying bone or bones.	
Pass of Paquani,	15,227

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[*] The following are some terms of comparison :—

	English Feet.
Javaher, in the Himalaya,	25,745
Chimborazo, in the Andes of Quito,	21,425
The Elbruz, in the Caucasus, according to Dr Kupfer,	16,411
Mont Blanc,	15,781
Peak of Teneriffe,	12,172
Malahasen, in Granada, in Spain,	11,663
La Malahite, in the Pyrenees,	11,421

	Feet.
As terms of comparison, we may mention, that, in the Alps, the Pass of the Furka, is	8,301
That of the Col de Seigne, is	8,071
And that, lastly, Mount Cenis and the Simplon, are only	6,778 and 6,578

Peruvian and Bolivian Cities.

Lima, the capital of Peru	512
Cochabamba, capital of the department of the same name,	8448

This town, of which the population is 30,000 souls, is more elevated than the Great Saint Bernard.

Chuquisaca, or La Plata, capital of the new republic of Bolivia,	9331
Tupisa, capital of the Bolivian province of Cinti,	10,004
La Paz, near the source of the Rio Beni,	12,195

La Paz is the most flourishing city in Bolivia. Its height above the level of the sea surpasses the highest summit of the Pyrenees.

Oruro, near to Desaguadero,	12,441

This city has a population of 5000 souls.

Puno, on the western shore of the Lake *Titicaca*,	12,832

The population of Puno is 5000.

Chucuito,	13,025

This city, more elevated than the highest summits in the Tyrol, had a population of 30,000 souls before the Indian insurrection excited by Tupac Amaru.

The grand place of Potosi,	13,314
The highest part of Potosi,	13,668

Potosi thus occupies the same height as the *Yung-Frau*, one of the most remarkable summits of the Alps of Berne.

Villages.

Tiaguanaco,	12,812

This village, situated on the shores of the Lake Titicaca, is celebrated for the ruins with which it is surrounded, which are remains of the most gigantic monuments ever erected by the Peruvians.

The surface of the Lake Titicaca is, above the sea,	12,703
Tacora, an Indian village,	14,252

Hamlets and Single Habitations.

Hamlet and post-station of Chullunquani,	13,869
Post-house of Ancomarca,	15,722

Here, then, is a post-house situated at a height equal to that of Mount Blanc. It must, however, be remarked, that, owing to the rigour of the climate, it is inhabited only three or four months during the year; but the route is taken, during every season of the year, by travellers journeying from La Paz, and other cities to the shores of the South Sea.

On the Chemical Constitution of Brewsterite. By ARTHUR CONNELL, Esq. F. R. S. E. (Communicated by the Author.)

THE formula of $3\left.\begin{matrix}\dot{Na}\\ \dot{Ca}\end{matrix}\right\}\dddot{Si}+4\,\underline{\dddot{Al}}\,\dddot{Si}^3+24\,\dot{H}$ has been given by Berzelius for the constitution of this mineral*; and, from a statement made by Dr Brewster †, it would appear that Berzelius had founded this formula on an analysis of Retzius. It gives,

Silica,	. . . .	57.286
Alumina,	. . .	17.011
Soda, Lime,	. . .	7.764
Water,	. . . .	17.872
		99.933

From some researches which I have made on the composition of Brewsterite, I have been led to the conclusion that this formula does not express the true constitution of the mineral, when derived from its almost only locality, Strontian in Argyleshire, and we must either suppose that some other mineral had been analyzed by Retzius, or that certain of the above constituents may be replaced by other substances. The specimens which I have examined I have shewn to Professor Jameson, whose name will be a sufficient sanction that no mistake exists as to their identity with Brewsterite. The most remarkable result which I have obtained, is the detecting baryta and strontia in the specimens under investigation; and this circumstance has induced me to offer this short notice on the subject, although my researches are not yet so far completed as to enable me to present a regular analysis of the mineral. The first specimen in which I found these earths, consisted of a kind of crystalline mass of concretions of Brewsterite, thickly studded with well formed crystals of the mineral. The portions of it examined were first exposed in small fragments to the action of largely diluted muriatic acid, to remove any calcareous spar or other matter soluble in such a menstruum. The decomposition was then effected by means of carbonate of soda, as the action of strong muriatic acid, although considerable, seemed not complete. Thinking it possible that the baryta and strontia might have been mingled, in some form or other, as impurities in the less perfectly crystallized portions of the mineral, I selected from a different specimen, a small quantity of well formed crystals of Brewsterite, with some small portions, which appeared to be fragments of crystals, my object being to avoid amorphous matter as much as possible. What I thus selected was first exposed to the action of water, acidulated with muriatic acid, for the same reason as before. It was then reduced to fine powder, and fused in platinum foil over the spirit-lamp, with a mixture of the carbonates of soda and potassa. After separating silica in the usual manner, and precipitating by ammonia, carbonate of potassa was added to the residual liquid, and the whole evaporated to dryness. Whatever was soluble was then removed by water. The residue, after being washed and ignited, dissolved with effervescence in dilute nitric acid, leaving a very slight dark residue. The solution by spontaneous evaporation, gave white crystals, which were chiefly thickish tables, and were not altered by exposure to the air. There was hardly any trace of deliquescent matter, shewing that the mineral could contain no notable quantity of lime, an observation perfectly supported by my examination of the other specimen. The crystals were next folded in platinum foil, and ignited over the spirit-lamp, to drive off the nitric acid. The residuum, which was dark coloured, was dissolved in dilute muriatic acid. The solution was set to evaporate spontaneously, and gave a mixture of tabular and of long prismatic crystals, partially coloured yellow, as by a salt of iron. The prismatic crystals were taken up by hot alcohol, and recrystallized from a watery solution. Both the tabular and the prismatic crystals, by ignition, became darkish, and when redissolved in water, left a dark coloured residue, which seemed, to a great extent, insoluble in muriatic acid, and gave traces of iron. The watery solutions, when recrystallized, gave well characterized crystals of muriate of baryta and muriate of strontia, the former being the more abundant of the two. The former tinged the flame of a candle slightly green or greenish-yellow, and the latter gave the well known fine red of salts of strontia. Both, when dissolved, gave white precipitates, with sulphuric acid.

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* See Poggend. Anal. xii. 18.

† Edinburgh Journal of Science, iv. 316. The formula has been there printed by mistake, $\frac{C}{N}S^3+4\,A\,S+8\,Aq$, instead of $\frac{C}{N}S^3+4\,A\,S^3+8\,Aq$, which is the formula corresponding to that in the text. In the Annal. de Chim. et Phys. xxxi. 21. it is given in the latter form.

On decomposing a quantity of the first mentioned specimen, by carbonate of baryta, I got no trace of alkali.

It is thus plain, that lime and soda do not enter into the constitution of the specimens examined by me in the quantity given by the formula of Berzelius. I have also reason to believe that silica and water are not so abundant as shown by that formula. The precipitate by ammonia, I have little doubt, was principally alumina.

It is not impossible that, as in Harmatome, baryta may be replaced by other substances, a similar replacement may occur with respect to this mineral.

I am unwilling to offer any opinion at present as to the quantity in which baryta and strontia exist in this mineral. It appeared to me, however, in my examination of the first specimen I have mentioned, that the baryta and strontia together, and including the insoluble residue remaining after ignition of the muriates, amounted to somewhere about 15 per cent. of the mineral. But I wish to be understood as giving no definite opinion at present on this point, or on the relative proportions of the two earths.

Supposing the earths to exist in the mineral in the state of silicates, which appears to follow from the preceding researches, this mineral will afford the second instance only, so far as I know, of baryta occurring in nature in any other state of combination than with sulphuric or carbonic acids, Harmatome being the first instance; and should the strontia be found to be in sufficient quantity to form an essential constituent, as my researches, so far as they go, seem to show, it will be the first instance of this earth occurring in nature, unless as a sulphate or carbonate.

I shall proceed in completing a regular analysis of this mineral as soon as possible.

Queries respecting the Natural History of the Salmon, Sea-Trout, Bull-Trout, Herling, &c. By Sir WILLIAM JARDINE, Bart. F. R. S. E., M. W. S., &c.

THE value of the Salmon Fisheries in Great Britain has decreased so much of late years, and particularly in the north of England, and south of Scotland, that a remedy for it, independent of its interest as a difficult and unsolved question in Natural History, will become of no little importance to proprietors. The following Queries are proposed, with the view and with the hope of gaining some information upon the natural history and economy of this valuable species. It is only by arriving at a correct knowledge of its various habits, and those of the species allied to it, which frequent our rivers in almost equal numbers, that we can hope to devise or accomplish any means of increasing the production, or of decreasing the certainly too extensive destruction of it in its different states.

The Queries relate only to its natural history, and answers are earnestly requested, stating facts relative to the opinions given, with the suggestion of additional queries, or any thing that will tend to illustrate the history of the species.

Address the Answers to Sir William Jardine, Jardine-Hall, by Lockerbie, Dumfriesshire.

Salmon.

1. At what age do Salmon commence spawning? and how often is it supposed that they have migrated to and from the sea, previous to their first parting with the spawn?

2. Do the males and females attain maturity at the same period or age? and do all of one age spawn nearly at the same season?

3. At what time do the young, or fry, first leave the rivers?

4. When do the young, or fry, first return to the rivers?

5. What is the size, weight, and appearance of the fry, on their first return from the sea, and under what denomination do they then go?

6. Are they so far arrived at maturity as to spawn, and be productive, on their first return from the sea, or previous to a second migration?

7. Are any *fish* known to shed their spawn abortively, before they arrive at their full growth or maturity? or is the spawn observable in young fish retained until the parents attain the ordinary growth and size of the species when it is known to be productive?

Grilse.

8. Are Grilse immature salmon, and if they are, what is their age?

9. What is the distinctive character between a *large Grilse* and a *small Salmon*?

10. At what season do grilses first appear in the rivers? What is their weight? and are they supposed to be the fry of the same year, on their first return from the sea?

11. Have the fry been marked, and afterwards taken as grilses in the course of the same year, and have grilses been marked, and afterwards taken as full grown salmon?

12. Is it supposed that any sexual intercourse takes place between the salmon and other species of the genus, thereby producing a mongrel or mixed breed of fish?

Whitlings and Sea-Trout.

13. Does the *Whitling* of the Tweed ever become a salmon—if not, to what size and weight does it attain?

14. Is the *Whitling* of the Tweed known by any other name in its various stages of growth? Does it spawn, and at what season? What are its migrations?

15. Is the *Sea-Trout* of some other rivers the same with the *Whitling* of the Tweed? Is it found in all rivers containing salmon? Does it spawn? Is the young, or fry known—and what are its migrations?

Herling *.

16. Is the *Herling* or *Hirling* of the Annan and Nith, and the *Whitling* of the Esk in Cumberland, the same with the *Finnock* of the west coast of Scotland, and the *Sewin* of the Welsh rivers?

17. Is the *Herling* found in the rivers on the eastern coast of Scotland, or in any of the rivers in England or Ireland, and under what name or names is it there known?

18. Does the *Herling* spawn, and at what season? and is it known in any intermediate state between the fry and *Herling*? Is the fry known, and what are its migrations?

Bull-Trout.

19. Is the *Bull-Trout* of the Tweed the same with the salmon-trout of the Tyne and Tees, &c.? and is it known by any other name during its growth from the Fry to maturity?

20. Is the *Parr* met with in all rivers containing salmon? where and when does it spawn? Is it the same with the *Brandling* of the North of England, and the *Skirling* of Wales? Is it supposed to be a perfect fish, or the fry of some species of salmon?

21. What is the Grey *(Salmo Eriox)* of Dr Fleming? What are its states from the young to the adult? What are its migrations?

22. Are there any species of migratory salmon, distinct from those above mentioned, known in the rivers of your neighbourhood?

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* The Herling seems to be the *Salmo Albus* of Dr Fleming's "British Animals," and most Ichthyologists. The species has not been thoroughly investigated.

On the various Preparations of Milk, particularly of Mares' Milk, used by the Kalmuck Tartars.

The ordinary drink of the Kalmucks, and which forms an essential part of their food, consists of various preparations of the milk supplied by their cattle. The mares yield milk as well as the cows; and, for several reasons, they prefer the former. When fresh, this milk has a taste of onions, which is very repulsive; but, in proportion as it sours, if the operation is performed with cleanliness, it becomes more liquid than the other, acquires an agreeable vinous taste, and neither forms cream nor coagulates. In this state, it furnishes a wholesome and refreshing drink, and which, when in sufficient quantity, froths in a remarkable degree. The cow's milk, on the contrary, both on account of the cheesy matter which it contains, and its disagreeable taste, becomes unpleasant to drink when it sours; and, in persons not accustomed to it, induces colics and diarrhœas, although the Kalmucks themselves experience no inconvenience from it, unless they have neglected to boil it. This they do, in the first place, and never use it until it has undergone this operation, without which they would be exposed to the inconveniences with which sour milk affects Europeans. In like manner, the Kalmucks do not relish water that has not been boiled. Poor persons, to prevent their being reduced to the necessity of drinking it pure, mix it with their milk, in the proportion of a third part or half, in order to make the most of the latter as a drink.

The milk is therefore heated as soon as it is withdrawn from the animal; and, when warm, it is poured into a large skin bottle, with which the poorest hut is furnished, and in which there is always a remnant of sour milk sufficient to sour the new milk after it has been stirred with a stick kept for the purpose. Those bottles are never washed or cleaned. They are therefore always incrusted with cheese and dirt, and the smell emitted by them is sufficient to shew what they contain. But it is precisely in this that the secret for making the milk undergo the vinous fermentation consists. If it be intended to sour milk in empty or new bottles, all that is necessary is to put into them the least drop of the milk-brandy to be presently described, or a little of the curdled milk that is found in the stomach of young lambs.

All the preparations of milk are comprehended under the name of Tchigan. The drinks prepared from pure mare's milk (the Koumys of the Tartars), are named Gunna Tchigan, or Horse Tchigan; those into which mare's milk and cow's milk enter, are called Besrek; sour cow's milk is named Airek, and all kinds of fresh milk, Ussoun.

In summer, and in general whenever their flocks yield them much milk, the Kalmucks do not fail to inebriate themselves with the strong drink which they derive from it. Mare's milk affords most spirit, and the milk of the cow affords much less, especially in winter when the fodder is dry. Sheep's milk is never employed, as it does not contain spirit.

The milk intended for distillation is only allowed to remain twenty-four hours, in summer, in the skin-bottles to sour; but in winter, and in cold weather, it may be left two or three days to be rendered fit for distillation. The cream is not taken off; on the contrary, the milk is agitated very strongly, from time to time, with the stick, and the butter which forms of itself on the milk, or even on the common Tchigan, is removed and employed for other uses.

Notwithstanding the numerous testimonies on the subject, and the daily experience, not of the nomadic tribes alone, but also of all the Russians, many people in Europe cannot conceive how a spiritous and inebriating liquor could be obtained from milk. But it cannot be supposed that those travellers who have repeatedly seen these tribes distil their brandy from milk, without adding the least vegetable matter to the original liquid, and then, in their unbridled passion for debauch, drink until they stagger and fall, have said so merely to impose upon the public. Nor can it be objected that the weakness of their head renders them liable to be easily inebriated by the vapours of the milk, for the Kalmucks can take very large quantities of grain brandy without losing the use of their legs; and there are Russians, who, although professedly great drinkers, are sooner inebriated than the Kalmucks by milk-brandy, and often even by the sour milk of mares, and yet are extremely fond of this kind of drink. I am aware that strangers have in vain tried to make milk-brandy. I shall even confess that I had a trial made under my own eyes, at Selenginsk, by Kalmucks, and was so unsuccessful, that I only obtained a watery fluid which had the smell of sour milk; but the reason of this was, that two clean vessels had been used. On the contrary, whenever I allowed these people to use their own vessels, abundant alcoholic vapours were procured. It is, therefore, an important point to determine, by means of vessels impregnated by long use, with a strong smell, and the remains of sour milk, that sudden souring which developes a spiritous principle. This fermentation of a rare species, and entirely *sui generis*, can only be brought to the desired perfection by frequent repetition of the process, just as, according to Russel *, the thick milk (*leban*), which the Arabs habitually use for making cheese, can only be obtained by producing the coagulation of the fresh milk by means of a milk previously curdled, or, in other words, by the cohobation many times repeated of curdled milk.

After describing the process of distillation, Pallas remarks, if the brandy is made from cow's milk, what is obtained is equal to the thirtieth, or at most to the twenty-fifth part of the mass; but when from mare's milk, it equals the fifteenth part. The new fluid is pale and watery, and does not inflame; but it keeps without spoiling, in glass bottles, like weak corn-brandy. The rich Kalmucks render it stronger by several distillations, and they have names for the products of each rectification. The *arki* is named *dang* after its first rectification; *arza*, after the second; *khortsa*, after the third. They seldom go farther, although the rectifications are sometimes pushed to six. The names given to the two last are *chingsta* and *dingsta*. The Kalmucks are generally, however, content with the products of the first distillation.

The receiver has scarcely been filled when they pour the brandy warm from it into a large wooden vessel with a spout, from which they fill leather bottles or gourds.

It is customary for the host, with whom the company is then to pour brandy into a vessel, and afterwards to throw part of it into the fire, and part towards the hole by which the smoke issues to render the spirits of the air or his tutelary angel propitious. Lastly, the warm brandy circulates among the company, composed of kinsfolk and friends, in large cups, which often do not hold less than a bottle. If a little is left, it is heated again before it is drunk. This milk brandy, on account of the aqueous parts which it contains, does not inebriate so easily when a small quantity is taken, as brandy made from grain; but it is found, by the example of the Russians and all the tribes of the Steppes, that the drunkenness which it causes continues longer, and entirely destroys the appetite. On the other hand, it does not produce violent headaches like corn-brandy.

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* Russel's Aleppo, p. 54.

The rich Kalmucks and Mongols are in the habit, when they pass the winter near towns, of distilling with or without milk brandy from leavened bread. The product, it is said, is stronger and has a keener taste than milk brandy. The residuum of the distillation of milk brandy, which is sharp and has a smell like wine lees, is applied to various uses. Sometimes it is mixed with fresh milk, and immediately eaten; sometimes it is applied for preparing sheep and lamb skins; sometimes the women boil it, either by itself, or, if it is too sharp, with a mixture of sweet milk, until it thickens, and then pour the cheesy substance into bags, which, when thoroughly dried, they throw into heaps. They also, like the Tartar tribes, frequently form it into round cakes, which they dry in the sun, and keep principally for journeys and for winter use. The residuum of distillation is called *bosson*, and by the Mongols *tsakha*. The cheese formed in heaps is named *chourmyk*, that in cakes, *thorossoun*.

They make another kind of cheese also, chiefly of sheep's and goats' milk. The fresh milk is put into a kettle with a like sour milk *(ederekseen ussum)*, or some remnant of brandy *(bossah.)* They are well mixed, and then left for some time to sour. Fire is then put under the kettle, and the mixture is stirred while it boils briskly, that the cheesy parts may be converted into a kind of froth *(koosoun.)* When all the aqueous parts of the milk are expelled by boiling, a little butter is added. The whole is again stirred, and left upon the fire until the froth begins to dry and turn brown. It is then ready, and if properly prepared, has an agreeable taste.

The Kalmucks make their butter in the following manner;— A sufficient quantity of cow's or sheep's milk is put into a kettle, and boiled for some time, after which there is added a little sour milk cream (*areyn.*) It is then withdrawn and allowed to stand until it sours, which does not require a whole day. This milk is then beaten with a kind of butter stick, and poured into an earthen pot or other vessel, when the decomposed butter comes to the surface, and is placed in vessels, skins, or dried stomachs, in which it is kept. If the milk still seems to contain fat, it is again treated in the same manner. This milk is called *tossoun* by the Kalmucks, and *arræma* by the Tartars [*].

Analyses of Limestones from the Quarries belonging to the Earl of Elgin, near Charlestown, in Fifeshire. By A. Robertson junior, Inverkeithing. Communicated by the Author.

These limestones were taken from three different strata of the vast deposite of *mountain limestone*, which is so extensively quarried in the neighbourhood of Charlestown. As this limestone is extensively used for building and the purposes of agriculture, and, besides, belongs to an interesting formation, I conceived that a chemical analysis of its principal varieties would prove acceptable not only in an economical, but also in a geological view.

A full detail of the modes of analysis was sent to Professor Jameson; but, as the processes contained nothing further than an accurate employment of the most improved methods, I do not consider it necessary to lay them before the public.

1. *Limestone of a grey colour, with foliated structure.*

At the instant when broken, a very peculiar and disagreeable odour arises from the fresh fracture, which, however, is dissipated in a few seconds. It afforded the following constituent parts:—

Carbonic Acid, 41·2; Lime, 50·2; Magnesia, 1·44; Alumina, 1·25; Silica, 5·56; Iron, 0·28; Manganese, a trace; Carbon, 0·13; Naphtha, a trace; = 100·06.

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[*] This article is drawn up from a MS. of the late Professor Pallas, of which an account is given in the ninth cahier of the Memoirs of the "Museum d'Histoire Naturelle."

2. *Greyish-brown Limestone, with splintery fracture.*

When fresh broken, like the former, it emitted a fœtid odour, which was of momentary continuance. It afforded, on analysis, the following ingredients:—

Carbonic Acid, 42·3; Lime, 51·6; Magnesia, 0·92; Alumina, 1·8; Silica, 2·76; Iron, 0·35; Manganese, a trace; Carbon and Sulphur, 0·26; Naphtha, 0·13; = 100·12.

3. *Compact ash-grey Limestone.*

On breaking, did not emit any particular odour. Its constituent parts I found to be as follows:—

Carbonic Acid, 40·25; Lime, 47·05; Magnesia, 2·59; Alumina, 0·95; Silica, 7·9: Iron, 0·56; Manganese, a trace; Carbon, 0·7; Naphtha, 0·7; = 99·44.

To ascertain whether any sulphuretted hydrogen was present in the gas evolved during the solution of the limestone in muriatic acid, a hundred grains of each of the limestones were separately dissolved in gas bottles. Within the bent tubes of these bottles, rolls of paper, covered with white lead, were placed, and the extremities of the tubes were conducted nearly to the bottoms of vials, into which had been poured a little very strong fuming nitrous acid. By transmission of the gas through these vials, its peculiar odorant principle was completely destroyed, and the nitrous acid contained in them being diluted with distilled water, after it had stood for some time, there was observed in it a barely perceptible quantity of whitish matter, resembling, in its appearance, sulphur deposited from hydrogen. The test papers were a little darkened by the gas from the ash-grey limestone, so very slightly so, that a close comparison with the original tint of the paper was necessary to discover the change; the others were a shade or two deeper in colour.

Judging from the appearance of the matter undissolved by the muriatic acid, these limestones, perhaps with the exception of the last, are not strictly uniform in composition, some of the constituent parts seeming to be only mechanically mixed, and unequally disseminated throughout the mass. The one which contains the greatest portion of naphtha, carbon, and sulphur, is also that which is lowest in the stratification.

A Uniformity of Climate prevailed over the Earth prior to the time of the Deluge?

It appears from the observations of geologists, that during the earlier periods of the earth's formation, there did not exist, among the then created animals and vegetables, that kind of geographical distribution which characterizes the organized beings of our time. Thus, in the lias and oolite deposites, by far the greater number of fossil vegetables belong to the family of Cycadæa; indeed, sixteen of the kinds distinguished by Brongniart, which is more than one-fourth of the whole, have a reference to the present existing genera Zamia and Cycas;—genera that belong to those which grow between the tropics, or on the confines of the tropics. In like manner, the stems of *Equisetum columnare*, Brong., ten feet long, which occur so abundantly in the lias, and leaves, from four to five feet long, of the genus *Meniscum*, also met with in this formation, belong to productions of a warm climate. The wide distribution of these fossil plants is also in favour of a uniformity of climate. Well defined remains of *Equisetum columnare* have been found in strata of lias, from the southern acclivity of the Alps to near the northern extremity of Scotland, in an extent, therefore, of fully 12 degrees of latitude; and the Ferns and Cycadæa, found along with them, belong to the same species, or to species so nearly allied, that we may justly conclude the external circumstances under which they existed were very much alike. According to Dr Richardson, there occurs, on the banks of the Mackenzie River, as far as 70° N. Lat., a coal formation, along with limestone and bituminous shale, which formation is probably identical with that in the county of Sutherland, in the north of Scotland. He found in it Ferns and Lepidodendrons; and the animal remains enumerated agree pretty well with those of the lias and Jura formation. There is, therefore, little probability of its being disproved, that, during the deposition of the lias, the same temperature prevailed in all countries, where this universal deposite was formed. M. Brongniart, and others, are inclined to believe, that the climate of the globe has changed gradually from the earliest to the present period. But proofs of the universal distribution over the globe of a climate, resembling that in the present tropical regions, are met with not only in the formations of the secondary period, but also in those of later periods. Monocotyledonous trees, which are of but rare occurrence on the southern boundary of the temperate zone, are found in a fossil state not only in the strata immediately associated with the chalk formation, but also in the beds of brown coal, and other strata of the tertiary class; and, although the numerous groupes of animal remains hitherto found in these formations have the greatest affinity to those animals which at present inhabit the seas and lands of lower latitudes, it is certainly no slight proof of the former distribution of one and the same climate over the whole earth, when, in coeval formations, we find the same fossil remains in widely different degrees of latitude. This, it is alleged, has been verified by observation. The same (or very nearly allied) organic remains, as those of the tertiary and diluvial strata of the basins of Paris and London, of the sub-Appenine hills, and of the shores of the Baltic, have been, we are told, recently observed in the same kind of strata on the banks of the Irrawadda in the Birman Empire, in the neighbourhood of the Brahmaputra in Bengal, and in Jamaica.

In conclusion, we need only cast a glance at the acknowledged locality of some of the extinct gigantic pachydermata, as the elephant, rhinoceros, &c., to be convinced, that, in the period of creation immediately preceding our own, there may have existed, on both shores of the Atlantic Ocean, to a distance extending from the mouth of the Lena, in 70° north latitude, to the tropic, a climate at least very analogous to that in the present tropical regions. From the preceding and other well known facts, we may venture to infer, that it was after the *Deluge*, that there first appeared those differences of climate which we were unable to shew had existed at any prior period; and that this event took place with such fearful rapidity that the inhabitants of the tropical woods and savannahs of Siberia were preserved uninjured, with all their tender parts, enclosed in the ice of the Arctic Sea.

H——N.

Notes on the Moth named Saturnia Luna—the Domestication of Foreign Butterflies—and the Geographical Distribution of Insects. Communicated by James Wilson, Esq. F. R. S. E. &c.

The most remarkable fact in the history of this beautiful species of moth, which is a native of North America, or, I ought rather to say, of certain individuals of the species, is, that through the zeal and ingenuity of Mr Sömmer, a German merchant, who resides in the Danish town of Altona, the eggs transported from a North American port have been hatched in Europe, and the perfect insect eventually produced in a state of the greatest beauty. I am not yet acquainted with the means made use of by Mr Sömmer in rearing the caterpillars, nor with the name or nature of the plants on which they were fed; but these and other particulars in the history of this interesting colony may be afterwards inquired into, and, I doubt not, will be freely communicated.

Mr Sömmer is well known among the scientific collectors of Hamburgh and Altona, and possesses an entomological cabinet of singular beauty and of great extent in the only department which he cultivates, that of the Lepidopterous order. The science of Entomology has been so prodigiously extended within these last few years, that, with the exception of Latreille, and one or two others of more than usual talent and perseverance, who have cultivated and adorned the universal field, the followers of this science have been obliged each to content himself with a mere section of the subject. Thus, Jodart and Duponehel have illustrated the Lepidoptera, Baron Dejean the Coleoptera, and Professors Fahleen of Lund, and Wiedemann of Kiel, the Dipterous tribes. Gravenhorst, indeed, has lately published three very thick volumes upon a family of Hymenopterous insects, the *Ichneumonidæ* alone. With the numerical extent of that particular family I am not acquainted, but the total amount of known species embraced by the science of Entomology, has been estimated at *one hundred thousand.* When we consider how many singular facts an attentive observance of the history and habits even of a single species brings to light, we may form some idea, however vague and inadequate, of the boundless and inexhaustible storehouse of materials, which any thing like a complete knowledge of the instincts and economy of the whole class would exhibit.

To return for a moment to the *Saturnia luna.* The introduction of this insect to Europe renders it extremely probable, that if entomologists were as assiduous in their own calling as botanists are in theirs, the eggs of many beautiful species might be transported from foreign countries, and bred here, and that thus a new source of admiration and delight would be created not only to the man of science, but to the poet and the painter. The greater proportion of those ornamental plants which now form the most attractive features in our gardens, are the original produce of foreign climes; and it would greatly add to their beauty, if a few of the many gorgeous butterflies which hovered around them in their original countries, were now seen among the parterres of the British flower-garden, or among the rich and varied pastures of England. The beautiful *Apollo Butterfly*, frequent in the Valley of Chamouni, and other parts of Switzerland, was found by M. Bory St Vincent, at a considerable elevation on the mountains of the Sierra Nevada in Spain; and, as it is an autumnal species, its eggs must be so constituted as to endure, without injury, the influence of the severe winters of Switzerland and other central parts of Europe. According to Degeer, it is not uncommon, even in Sweden, where it will probably be found to occupy less elevated stations than in the south, in conformity with a rule which obtains both among plants and animals, viz. the higher the latitude the lower the locality, and *vice versa.* In trying entomological experiments of the kind alluded to, care, of course, should be taken to import only such species as are known not to feed upon culinary or other plants of value, for their economical uses. It may be objected to the practicability of such endeavours, that the larva would necessarily perish for want of those particular plants on which their progenitors had been accustomed to feed; but I believe, that as necessity is the mother of invention among the human race, so among the more insignificant tribes of the insect world; though a decided preference may be exhibited to one plant rather than another, yet where that chosen one does not exist, life is vigorously sustained by numerous substitutes. The silk-worm, in default of its favourite mulberry leaves, thrives well upon lettuce and other plants.

In regard to North American species especially, Nature herself points out, that the character of the climate, in relation to the development of insect life, possesses many attributes in common with that of Britain and other portions of Europe. Many of the species are alike common to both continents, and an interesting and instructive list might be drawn up in illustration of this community of kinds. This, however, must be done from the specimens themselves, and not from books of travels, or other general sources, the authors of which, till of late years, applied the supposed synonyms of animals always in a vague, and frequently in an inaccurate manner. This reproach is now removed by the admirable descriptive catalogues which, in the form of natural history appendices, are annexed to or follow the publication of all voyages of discovery or other records of travel.

It is in considering the widely extended distribution of many of the forms of insect life, that the subject of the geographical allotment of animals is seen under its most curious and truly wonderful aspect. A discovery ship under the guidance of brave men, surmounts with difficulty the terrors of the ocean, and after being months on the trackless main, and some thousand miles from any of the great continents of the earth, she arrives at last, and accidentally, at some hitherto unknown island of small dimensions, a mere speck in the vast world of waters by which it is surrounded. She probably finds the "Lord of the creation" there unknown,—but though untrod by human footsteps, how busy is that lonely spot with all the other forms of native life! Even man himself is represented not unaptly by the sagacious and imitative monkeys, which eagerly employ so many vain expedients to drive from their shores what they no doubt regard as merely a stronger species of their race. "Birds of gayest plume" stand fearlessly before the unsympathizing naturalist, and at every step of the botanical collector, the most gorgeous butterflies are wafted from the blossoms of unknown flowers, and beautify the "living air" with their many splendid hues; yet how frail are such gaudy wings, and how vainly would they now serve as the means of transport from that solitary spot where all the present generations have had their birth! In what manner, then, did they become its denizens, or by what means were they transported to a point almost imperceptible in comparison with the immeasurable extent of the circumjacent ocean. These are subjects of inquiry, a few out of many such, which it is more than probable man will never solve.

> "In his tam parvis atque tam nullis quæ ratio!
> Quanta vis! quam inextricabilis perfectio!"

The primary causes of the distribution of species, as well in the animal as the vegetable world, are, in the opinion of Humboldt, among the number of mysteries which mere natural science cannot reach. This science, or the branch of it which takes cognizance of zoological geography, is not, however, occupied in the investigation of the origin of beings, but rather of the laws according to which they are now distributed over the surface of the earth. It is the spirit of inductive philosophy applied to the ascertained facts of zoology, as connected with clime and country. It enters into an examination of things as they are, the co-existences of vegetable and animal forms in each latitude, at different heights, and at different degrees of temperature; it studies the relation under which particular organizations are more vigorously developed, multiplied, or modified; but it approaches not problems, the solution of which is impossible, since they touch the origin or first existence of the germs or life.

Many interesting facts have been ascertained and detailed by scientific observers of late years, which, in a collected form, would serve as the basis of a memoir on animal geography, which, however imperfect, would scarcely be devoid of interesting and important results.

Account of several New Species of Grouse (Tetrao) *from North America.*

At a late meeting of the Wernerian Society, James Wilson, Esq. F. R. S. E., &c. gave a detailed account of several new species of grouse discovered by Mr. David Douglas among the Rocky Mountains in North America. He observed in general, that birds of this genus are of a hardy constitution, and patient of extreme cold. They only occur in northern or temperate countries, and have not yet been discovered in Africa, in the eastern parts of Asia, or in South America. The special localities which they affect vary according to the different kinds; and even the haunts of the same species admit of variation according to circumstances. The Wood Grouse—such as the Capercailzie (*Tetrao Urogallus*)—prefers forests of pine; the Red Grouse (*T. Scoticus*) restricts itself to the sides of sloping mountains and moors, careless of more shelter than is afforded by the heath, or other alpine plants of yet more lowly growth, or even by the natural roughness of the ground. The habits of the Black Cock are intermediate between those of the species just alluded to. Ptarmigans (of which the species of Europe and America are still insufficiently characterized and distinguished) prefer, in comparatively temperate climates, such as that of Scotland, the bare and stony sides and summits of our highest mountains; but under the rigorous temperature of Greenland, and the most northern parts of America, they are chiefly found by the sea-shore, and among the willow and other copse woods of the lower and more sheltered vales. The restriction of the Common Grouse (*T. Scoticus*) to the two islands of Great Britain and Ireland, is a familiar though a singular fact in the geographical distribution of birds. The first and most remarkable of the specimens to which it was Mr Wilson's more immediate object to direct the attention of the Society, was the *Tetrao Urophasianus*, or Pheasant-tailed Grouse, the largest of the American species of this genus, and, excepting the Capercailzie, the largest to be met with in any country. This bird seems to have been observed by Lewis and Clarke, by whom it is mentioned under the name of Cock of the Plains; and a notice of it was published, some time ago, in the Zoological Journal, by Chas. Lucien Buonaparte, who obtained an imperfect specimen of the male in London. The length of this bird (when full grown) is 32 inches; its girth 22; its weight from 6 to 8 lb. The female is considerably less than the male. Her plumage closely resembles his, except that she wants the lengthened filamentous feathers on each side of the neck, and differs slightly in the colour of chin, cheeks, throat, and breast. The flight of these birds is slow and unsteady. Their wings are feeble and proportionably small; their progress through the air is effected by a fluttering motion, rather than a direct continuous flight. When raised, their voice resembles that of the common pheasant.

They build on the ground, beneath the shade of *Purshia* and *Artemisia*, or near streams among *Phalaris Arundinacea*. The nest is carelessly constructed of grass and twigs; the eggs (from 13 to 17 in number) are about the size of those of a common fowl, of a wood-brown colour, irregularly blotched with chocolate-brown at the larger end. The period of incubation is about three weeks, and the young leave the nest a few hours after they are hatched. In the summer and autumn months, these birds are to be found in small troops; in spring and winter, in flocks of several hundreds. They never perch; indeed, within their range, not a bush larger than a broom or common whin is to be found. Their food consists chiefly of the buds, leaves, and fruit of *Purshia tridentata*, *Artemisia*, the seeds of *Cactus*, brown and black ants, and sand-bugs. Their flesh is dark-coloured, and not particularly well flavoured. They are plentiful throughout the plains of the Columbia River, and in the interior of North Carolina; but have never been seen east of the Rocky Mountains.

The next species, in size and importance, is Richardson's Grouse (*T. Richardsonii*), so called in honour of the distinguished traveller of that name. There is a remarkable difference in this species between the plumage of the male and female. The weight of these birds varies from 2½ to 3 lb. Their voice is a continuation of distinct hollow sounds, like the cooing of a dove. They build their nests of small twigs, leaves, or grass, amid coppices of birch or hazel, in the vicinity of springs or mountain rills. They lay from 13 to 19 eggs, nearly as large as those of the domestic fowl, marked with red specks. Their flight is swift, steady, and peculiarly graceful. When startled, they drop from the branches of the pine-trees, their usual roosting-place, to within a few feet of the ground, before they commence flying—a circumstance which often deceives the hunter. This trait seems peculiar to the species. In spring, they are seen in great numbers, basking in the sun, on the southern declivities of low hills; and, in winter, in flocks of sixty or eighty, in the vicinity of springs, lakes, or large streams. They are easily destroyed, continuing to sit with apparent tranquillity after several shots have been fired. Their flesh is white and excellent. They feed on the buds of the pine, the catkins of birch, alder, and hazel, and the fruit of the *Fragaria* and *Vaccinium*. They are very abundant in the sub-alpine regions of the Rocky Mountains, in Lat. 52 deg. N., Long. 115 deg. W., and still more numerous in the rocky districts of the Colombia, in Lat. 48 deg. N., Long. 118 deg. W. They are rare on the mountains of the N. W. coast *.

The third species exhibited was named the smaller Pheasant-tailed Grouse (*T. Urophasianellus*). The sexes resemble each other closely in colour, but the male is rather larger than the female, and his tail more fully developed. Their prevailing colour is pale brown, richly blotched and barred with black. The wing-coverts, and the outer webs of the primary wing feathers, are marked with many rounded or oblong spots of a pale colour. Their flight is swift, noiseless, and steady. They are shy, and not easily approached by the sportsman. They are found in the same range of country with the larger species first described, with which they associate, and which they resemble much in their habits. The number of their eggs varies from 12 to 15, in size not much exceeding those of a pigeon, and in colour of a light ash.—The fourth species has been named, in honour of Mr Sabine, *Tetrao Sabini*. The plumage is rich and varied, and presents those singular appendages or shoulder-knots, so conspicuous in the wood-partridge of the United States and Canada (*Tetrao Umbellus*.) The colours in the plumage of the female are greyer, and less richly toned—in other respects, the sexes do not much differ. The weight of an individual bird is two pounds. Their voice is a continuation of measured sounds, not unlike the ticking of a large clock. Their flight is rapid, and consists of a quick clapping of the wings, and then of a sudden shooting forwards, without any perceptible motion of the individual parts. They feed on the buds of *Pinus*, *Fragaria*, *Rubus*, *Corylus*, *Alnus*, and the berries of *Vaccinium*. They pair in March, and build upon the ground, in coppices of *Corylus*, *Amelanchier*, and *Pteris*, and on the outskirts of pine forests. Their nests are composed of the slender fronds of *Pteris*, dry leaves, and grass. Their eggs are of a dingy white, with red spots, and vary in number from 9 to 11. They are remarkable for attachment to their young. The *Tetrao Sabini* is a rare bird. During spring, it is found in small flocks, rarely exceeding eight or twelve; at other seasons, it seldom happens that more than three or four are seen together. Like the *Tetrao Umbellus*, which it resembles in the prevailing character of its plumage, it is in the habit of perching upon the stumps of decayed trees, in the darkest parts of the forests, and there performing the singular operation called *drumming*; which is effected by giving two or three loud distinct claps with its wings, followed by many others, which become quicker and quicker, until the noise appears to die away in the distance, like the sound of a muffled drum. This beautiful species was discovered by Mr Douglas, in the woody parts of the N. W. coast of America, between the parallels of Lat. 40 deg. and 49 deg.

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* *Tetrao Richardsonii*, as above described, appears to be synonymous with the *Tetrao obscurus* of Say, recently figured by Lucien Charles Buonaparte in his American Zoology. The latter name, as prior in date, is probably entitled to the preference, although we believe that no copy of Buonaparte's work had reached this country at the time Mr Wilson published the figure of *Tetrao Richardsonii* in the 8th Number of his *Illustrations of Zoology*.

The fifth and last species exhibited, is called, in honour of the distinguished commander of the over-land Arctic Expedition, *Tetrao Franklinii*. Mr Wilson has as yet seen only the male.

The general plumage is dark and glossy, composed of alternate bars of black and greyish brown. The head, neck, and breast, are almost black; the tail is entirely black. The upper and under tail-coverts are black, terminated by a large white spot; and the lateral parts of the abdomen are likewise spotted with white. It runs with great speed over shattered rocks and among brushwood, and only uses its wings as a last effort to escape. When raised, its flight is similar to that of the last-mentioned species. Its alarm note is composed of two or three hollow sounds, ending in a disagreeable grating noise, like the latter part of the cry of the Guinea fowl. Like other birds of the same genus, it builds on the ground, not unfrequently at the foot of decayed stumps, or by the side of fallen timber, in the mountain woods. Its nest is composed of dead leaves and grass, and contains from five to seven eggs, of a dingy white colour, not larger than those of our wood-pigeon. It is said to be one of the most common birds in the valleys of the Rocky Mountains, from Lat. 50 deg. to 54 deg. N., near the sources of the Columbia. It probably inhabits still higher latitudes.—Mr Wilson remarked, in conclusion: "I have little doubt that some of these birds might be imported into this country, of which the soil, climate, and natural productions, are not so dissimilar to those of their native regions, as to preclude the hope of a successful issue to an experiment of a very interesting nature, which the wealth and zeal for field sports, inherited by many of our aristocracy, would render easy, and which might eventually prove of more permanent and substantial advantage. Their importation would certainly form a fine addition to the feathered game of Great Britain."

Description of several New or Rare Plants which have lately flowered in the neighbourhood of Edinburgh, and chiefly in the Royal Botanic Garden. By Dr GRAHAM, Professor of Botany in the University of Edinburgh. With a Plate illustrative of the germination of the Nepenthes distillatoria.

10th Mar. 1830.

Cestrum bracteatum.

C. *bracteatum;* filamentis basi barbatis; foliis lanceolatis undulatis pubescentibus; stipulis oblique cordato-reniformibus; bracteis spathaceis; floribus fasciculatis.

Cestrum bracteatum, *Link & Otto*, Icones Plant. Rar. Hort. Reg. Bot. Berol. Part I. p. 11, t. 6.

DESCRIPTION.—*Stem* woody, rough. *Branches* covered with dense, greenish tomentum, which withers and remains long attached. *Leaves* scattered, light green, stalked, spreading, lanceolate, strongly veined, waved or crisped, covered with harsh pubescence on both sides, the middle rib and veins projecting much on the under-side, the former above also. *Petiole* erect, grooved above, pubescent, purple before fading, about a sixth of the length of the leaf. *Stipules* geminate, varying in size, the largest upwards, broadly falcate or kidney-shaped, horizontal and bending round the branch, more glabrous than the leaves. *Peduncles* (about an inch long) axillary and terminal, generally about twice as long as the petioles, slightly flattened and dilated towards the flowers. *Pedicels* very short, stout, straight, slightly pubescent. *Flowers* fascicled, nodding, of a uniform pale yellow. *Bracteæ* single at the base of each flower, with the exception of the central one, spathe-like, appressed, acuminate, and coloured like the flower, pubescent. *Calyx* about as long as the pedicel, pubescent within and without, nearly cylindrical, with five strongly projecting ribs on the outside, leading to five slightly connivent acute teeth. *Corolla* inferior, hypocrateriform, pubescent without, smooth within; tube nearly an inch long, dilated a little upwards, and contracted at the throat: limb 5-cleft, segments ovate, acute, spreading at right angles to the tube, each with two strong ribs projecting behind. *Stamens* five; filaments inserted immediately above the middle of the tube, each having a tuft of matted hairs projecting from the inside at their base, above this straight and smooth, nearly reaching to the faux. *Anthers* bilobular, short, connivent, bursting laterally: pollen yellowish-white. *Stigma* sap-green, nearly round, but flattened a little at the top, raised above the anthers, and projected into the faux. *Style* (three quarters of an inch long) nearly colourless, filiform. *Germen* roundish or obovate, smooth, yellowish-green, obscurely furrowed, seated on a small yellow disk. *Ovules* numerous, obovate.

We received this plant from the Botanic Garden of Berlin, in June 1828. It is a native of Brazil, and blossomed in the stove of the Edinburgh Botanic Garden in December 1829, producing, during a considerable time, a succession of rather ornamental flowers.

Conostylis aculeata.

C. *aculeata;* perianthiis intus glabris, scapis corymbisve divisis, foliis glabris margine aculeatis: aculeis interstitio brevioribus.—*Br. Prodr.* 309.

DESCRIPTION.—*Leaves* (6–13 inches long ¼ inch broad) dull green, red at the base, distichous, equitant for about two inches at the base, ensiform.

falcate, sometimes twisted, coriaceous, stiff, many-nerved, glabrous, aculeate; aculei colourless, straight, ascending, rigid, rising from coloured bases. *Scape* terminal, decumbent, 7 inches long, sparingly branched, round, branches rising from the axils of sheathing pointed *bracteæ*, which (are about an inch long, and) diminish upwards. *Inflorescence* a corymbose cyme. *Flowers* crowded. *Perianth* campanulate at the base, persisting, 6-parted, segments erect, ovato-lanceolate, concave, regular and nearly equal, yellowish-white and smooth within, without greenish-yellow, and, as well as the scape, base of the bracteæ, and pedicels, covered with a branching greenish tomentum. *Stamens* six, inserted into the perianth, filaments adhering to the perianth for the greater part of their length, smooth, slightly connivent, prolonged by the back of the anthers, which are longer than them, and are linear, erect, slightly bent backwards, yellow, bilocular, bursting along their edges; pollen yellow. *Pistil* single, shorter than the stamens; stigma of three short suberect points; style single, rigid, smooth, persisting, slightly tapering; germen half inferior, 3-locular, conical and empty above the perianth; ovules numerous in each loculament, round, attached to a central receptacle, which is undivided and prominent in each loculament, confined to that part of the germen below the perianth.

Our specimen of this plant was received from Robert Barclay, Esq. Bury-hill, in 1828, and flowered in January and February last.

Elephantopus Martii.

E. *Martii;* caule ramoso, piloso, folioso; foliis subsessilibus, undulatis, rugosis, supernè hispidis, subtus tomentoso-pubescentibus, serrato-crenatis, denticulatis, inferioribus spathulato-oblongis, breviter attenuatis, superioribus lanceolatis.

Elephantopus scaber, *Herb. Martii.*

Description.—*Stem*, including the flowering-stalks, in our plants, which are still growing, ten inches high, but in native specimens much more, herbaceous, erect, branched, flexuose, covered with simple, spreading, rather harsh hairs, which are most numerous on the younger branches. *Lower leaves* (6 inches long and 2 broad) spathulato-oblong, shortly attenuated, decurrent along short petioles, stem clasping, corrugated, undulate, serrato-crenate, pubescent on both sides, pubescence harsh above, soft and much more dense below; middle rib very large, prominent on both sides, especially below, flattened or slightly channelled above, primary veins very prominent below, oblique, with transverse prominent reticulations terminating in little mucros, which in the lower leaves are in the bottom of the indenations; *upper leaves* lanceolate, and diminishing upwards, but otherwise similar to the lower. *Bracteæ* ovate, sessile, similar in colour and structure to the leaves, solitary, or, at the extremities only, three together from the confluence of three capitula. *Flowers* all hermaphrodite, capitate, axillary or terminal, sessile. *Involucra* chaffy, imbricated, generally four-flowered; chaffs few, imbricated, lanceolate, mucronate, three-nerved, keeled, erect, entire, or serrated towards the apex, green, scariose at the edges, pubescent on the outside, smooth and shining within, longer than the bracteæ, the four innermost subequal, and twice as long as the others. *Corolla* small, purplish-white, tubular, smooth; tube longer than the involucrum, curved, slender; limb 5-parted, segments secund, equal, linear-lanceolate. *Stamens* shorter than the limb; filaments slender; anthers linear, unconnected at least after expansion. *Stigma* hairy, bi-parted, revolute. *Style* exserted, filiform, smooth excepting near the stigma. *Germen* green, obovate. *Achenia* obconical, with ten smooth ribs, interstices pubescent. *Pappus* of few (10?) rough simple hairs, dilated and slightly ciliated at their bases, shorter than the tube of the corolla.

Seeds of this plant were sent to me from Mr Harris at Rio Janeiro by Captain Graham, late of his Majesty's Packet Service, in April 1829. It has been kept in the stove, and flowered in February and March last. It certainly nearly approaches to *Elephantopus scaber*, but may be distinguished from this species, which is moreover a native of the East Indies, by being much larger, its stem much more branched, the leaves more corrugated, more undulated, more strongly reticulated, and much more densely covered with far softer pubescence below. I am enabled to identify it as the plant of Martius, by a specimen communicated by Martius himself to Dr Hooker, who, with his usual kindness, permitted me to examine all the species in his herbarium. The specimen alluded to was collected by Martius on the Rio Belmonte, too common a name to be very precise, but probably in or not far from the province of Rio Janeiro.

Lobelia Kraussii.

L. *Kraussii*; caule herbaceo, glabro, erecto, ramoso; foliis lanceolatis, subsessilibus, decurrentibus, argute serratis, utrinque nudis; pedunculis axillaribus, solitariis, foliis longioribus; laciniis calycinis subulatis, subdentatis, patentibus, corollaque glabris.

Description.—*Root* perennial. *Stem* (1–1½ foot high) succulent, green, glabrous, angular from decurrent leaves, erect, branched. *Leaves* (4½ inches long, ¾ broad) numerous, scattered, lanceolate, glabrous on both sides, shining, bright green, paler below, sharply serrated, the serratures largest at the base, subsessile, decurrent, much smaller towards the top of the stem, slightly bullate, strongly veined, veins prominent on both sides. *Peduncles* (3 inches long) axillary, solitary, numerous towards the top of the stem, 1-flowered, nearly twice the length of the diminished leaves from the axils of which they spring, smooth, compressed, and having two subopposite bristle-shaped smooth decurrent bracteæ near the middle, below which they are bright green, paler in the middle, and towards the top red. *Calyx* red, glabrous, persisting, of five rather unequal subulate segments (5–7 lines long), spreading at right angles to the peduncle, and each with a very few obscure teeth. *Corolla* (1 inch long) red, marcescent; tube compressed, cleft to its base along the upper side, but spreading little; limb 5-parted, segments linear-subulate, with the apices deflected, the two upper the broadest, the three others turned downwards, and that in the centre rather the smallest. *Stamens* shorter than the corolla, marcescent; filaments white, smooth, forming a half cylinder, and united, except towards the base, where only they are unconnected to each other and pubescent; anthers leaden-coloured, terminated by a dense white beard; pollen abundant, and whitish. *Stigma* bilabiate, segments revolute, rounded, glandular, slightly hairy behind. *Style* as long as the stamens, yellowish, and slightly clavate, continued downwards into the dissepiment, marcescent. *Germen* glabrous, bilocular, with a conical empty beak (which afterwards falls down) rising above the calyx, otherwise inferior. *Ovules* numerous, attached to a central receptacle, the transverse section of which is kidney-shaped in each loculament. *Seeds* minute, pale brown, lenticular, hollow on one side, when seen under the microscope dotted and shining.

The seeds of this plant were obligingly communicated to me from Dominica in September 1828 by my valuable correspondent Dr Krauss, in acknowledgment of whose kindness I have named the species. It first flowered in the stove in January and February last, and is ornamental. In the arrangement of the species, it must stand near *L. persicifolia* of Lamarck.

Nepenthes distillatoria: fœm.

Early in summer 1828, I was informed by Professor Dunbar of this University, that a plant of *Nepenthes distillatoria* was coming into flower in his stove. I immediately went to see it, and was not a little pleased to find that it was a female. Professor Dunbar was kind enough to permit its removal to the Botanic Garden, where we placed it beside our male plant, fortunately then in flower for the second time. As the female flowers expanded in succession, we dusted the pistilla with the pollen, secreted in abundance by the male plant, and had the satisfaction to see the germens gradually enlarge, and the seeds ripen in succession in December and January.

Description.—The habit and inflorescence of the female is so precisely like that of the male described at length in the Edinburgh New Philosophical Journal for October 1827, and in Botanical Magazine, fol. 2798, and the figure of the female blossom taken from Mr Loddiges' plant, and published in Bot. Mag. t. 2629, under the name of *N. Phylamphora*, is so accurate, that I shall here add very little to the account of the adult plant. *Pitchers* of firmer texture in their lower half, and the inner surface of this portion, as well as the inner surface of the lid, is covered with conspicuous glands. *Raceme*, or more properly *panicle*, crowded, from the lowest pedicel to the apex about ten inches long. *Capsule* (1 inch long) erect and secund perhaps from the peduncle pushing out horizontally, ovato-oblong, truncated, crowned with four flat, sessile, brown, hard, emarginate stigmata, tetra-locular, tetra-valvular, two opposite sutures, opening before the others, dissepiments from the centre of the valves. *Seeds* dicotyledonous, very numerous, attached to the dissepiments, erect, small, provided with a brown arillus, which is ¼th of an inch long, and greatly attenuated at both its extremities, angular or furrowed, flexuose, and slightly twisted; nucleus ovato-oblong, pointed at both ends, about a fifth of the length of the arillus, and nearly occupying its centre, yellowish; embryo central, straight, white.

Plate VI. contains a sketch of our male plant, made about two years ago, when it was eight feet high. It is now 16¼ feet above the surface of the soil, and perfectly healthy, but scarcely more branched, one branch only having come out under each of two panicles.

Germination. Plate VI. also shews the ripe seeds, the germinating seeds, and the young plants in different stages of advancement. Some of the seeds were sown as soon as they were ripened, and others at various periods during spring. They required much heat to make them germinate, and protection by a plate of glass laid over the pots, which stood in flats filled with water. Germination began in April and May. Fig. 1. Arillus of ripe seed laid open, to show the relative position and size of the nucleus still covered by its inner coat, which is seen extending towards the extremities of the arillus. 2. Nucleus removed from the arillus, and divided, to show the embryo. 3. Seed with germination just beginning, the plume rising in form of an arch, the apices of the cotyledons being still held down within the albumen. 4. Slit in the upper part of the arillus spreading, the plume erect, albumen absorbed, the cotyledons spreading, the first pitcher scarcely appearing in the centre. 5. Germination advanced another stage, the first pitcher with its lid closed erect, and the radicle pushing through the arillus on the opposite side from the plume. 6. Three pitchers evolved, having each two prominent ciliated wings, and the upper surface of the lid muricated, the two first sessile,—the cotyledons deflected, and beginning to fade,—the radicle branched. 7. Five pitchers formed, the three last upon the apices of small leaves, but without any intervening cirrhus;—the cotyledons more deflected, and greatly wasted. The arillus remains in all these, in conssequence of being transfixed by the radicle. All but Fig. 7. which is of natural size, magnified. The accurate Gærtner (De Fruct. et Sem. Plant. 2. 18.) never could have called these seeds monocotyledonous if he had seen their germination.

It appears from the above, that the pitcher is an appendage to the middle rib of the leaf, this (the leaf) originally consisting of the ciliated wings of the pitcher only, but is subsequently elongated downwards, and at last the membranous expansion along the pitcher degenerates into two prominent nerves, and for a considerable way along the middle-rib is entirely removed, leaving this to act as a long simple cirrhus.

Celestial Phenomena from April 1. *to July* 1. 1830, *calculated for the Meridian of Edinburgh, Mean Time.* By Mr George Innes, Astronomical Calculator, Aberdeen.

The times are inserted according to the Civil reckoning, the day beginning at midnight. —The Conjunctions of the Moon with the Stars are given in *Right Ascension*.

APRIL.

D.	H.	′	″	
2.	17	40	20	☌ ☽ ♄
3.	8	50	42	☌ ☽ ξ ♌
5.	20	22	33	☌ ☽ σ ♌
6.	8	10	10	☌ ☽ β ♍
6.	23	57	58	☌ ☽ η ♍
7.	11	36	23	☌ ☽ γ ♍
8.	2	34	6	☌ ☽ ϑ ♍
8.	7	18	3	○ Full Moon.
9.	11	34	24	☌ ☽ κ ♍
10.	3	39	8	Im. II. sat. ♃
11.	5	26	36	☌ ☽ γ ♎
12.	8	29	9	☌ ☽ φ Oph.
13.	3	54	37	Im. I. sat. ♃
15.	14	52	31	☌ ☽ ♃
16.	6	36	39	☾ Last Quarter.
16.	16	59	0	☌ ☽ β ♑
16.	20	15	26	☌ ☽ ♂
17.	8	16	48	☌ ☽ ♅
18.	19	30	0	☌ ☽ ϑ ♒
19.	10	55	26	☌ ☽ λ ♒
19.	11	46	25	☿ very near ο ♓
19.	22	54	12	☌ ☽ ♀
20.	14	47	35	☉ enters ♉
22.	7	36	–	Sup. ☌ ☉ ☿
22.	23	12	20	● New Moon.
23.	0	54	–	☌ ☽ ☿
25.	1	3	18	☌ ☽ γ ♉
25.	2	15	3	☌ ☽ 1 δ ♉
25.	2	42	47	☌ ☽ 2 δ ♉
25.	7	25	47	☌ ☽ α ♉
26.	.	.	. .	☍ ☉ ⚴
27.	14	58	29	☌ ♂ ♅
29.	2	8	41	☌ ♂ ϑ ♑
29.	2	10	4	Im. I. sat. ♃
29.	19	38	26	☽ First Quarter.
30.	0	29	45	☌ ☽ ♄
30.	.	.	. .	☍ ☉ ⚳
30.	2	34	16	☌ ☿ ϑ ♈
30.	15	4	6	☌ ☽ ξ ♌

MAY.

D.	H.	′	″	
3.	3	20	14	☌ ☽ σ ♌
3.	14	20	12	☌ ☽ β ♍
4.	6	0	25	☌ ☽ η ♍
4.	17	41	7	☌ ☽ γ ♍
5.	8	41	9	☌ ☽ ϑ ♍
6.	14	52	12	☌ ☿ A ♉
6.	17	42	52	☌ ☽ κ ♍
7.	23	45	30	○ Full Moon.
8.	1	30	9	Im. III. sat. ♃
8.	11	25	37	☌ ☽ γ ♎
9.	14	19	18	☌ ☽ φ Oph.
11.	23	15	47	☌ ♂ γ ♑
12.	18	37	11	☌ ☽ d ♐
12.	21	9	0	☌ ☽ ♃
13.	23	1	37	☌ ☽ β ♑
14.	15	21	34	☌ ☽ ♅
14.	15	52	56	☌ ♂ δ ♑
15.	11	44	10	☌ ☽ ♂
15.	16	1	11	☾ Last Quarter.
16.	.	.	.	♀ greatest elong.
16.	18	42	51	☌ ☽ γ ♒
17.	4	20	53	☌ ☽ φ ♒
18.	23	9	16	☌ ☽ ♀
21.	.	.	.	☿ greatest elong.
21.	15	2	52	☉ enters ♊
22.	2	19	48	Im. I. sat. ♃
22.	6	56	43	● New Moon.
22.	18	1	2	☌ ☽ α ♉
23.	20	45	–	☌ ☽ ☿
24.	16	37	45	☌ ☿ 132 ♉
27.	11	20	50	☌ ☽ ♄
27.	22	39	14	☌ ☽ ξ ♌
29.	4	33	1	☌ ☽ ρ ♌
29.	10	2	27	☽ First Quarter.
30.	9	0	58	☌ ☽ σ ♌
30.	20	56	27	☌ ☽ β ♌
31.	12	33	33	☌ ☽ η ♍

JUNE.

D.	H.	′	″	
1.	0	13	29	☌ ☽ γ ♌
1.	9	10	24	☌ ♀ ο ♓
1.	15	14	14	☌ ☽ ϑ ♍
3.	0	19	17	☌ ☽ κ ♍
4.	18	0	45	☌ ☽ γ ♎
5.	20	34	36	Em. III. sat. ♃
5.	20	45	57	☌ ☽ φ Oph.
6.	0	10	2	Im. II. sat. ♃
6.	14	4	29	○ Full Moon.
7.	0	36	20	Im. I. sat. ♃
9.	0	14	38	☌ ☽ d ♐
9.	0	32	17	☌ ☽ ♃
10.	20	18	24	☌ ☽ ♅
12.	23	29	48	☌ ☽ ♂
13.	0	25	15	☌ ☽ λ ♒
13.	0	34	59	Em. III. sat. ♃
13.	10	14	12	☌ ☽ φ ♒
13.	22	36	10	☾ Last Quarter.
15.	18	15	–	Inf. ☌ ☉ ☿
17.	10	26	36	☌ ☽ ♀
17.	23	33	40	Im. IV. sat. ♃
18.	2	3	14	Em. IV. sat. ♃
18.	21	13	26	☌ ☽ γ ♉
18.	22	26	0	☌ ☽ 1 δ ♉
18.	22	54	1	☌ ☽ 2 δ ♉
19.	3	39	27	☌ ☽ α ♉
20.	1	23	12	Im. III. sat. ♃
20.	3	20	–	☌ ☽ ☿
20.	4	34	52	Em. III. sat. ♃
20.	14	51	23	● New Moon.
21.	23	38	47	☉ enters ♋
22.	22	53	31	Im. I. sat. ♃
24.	5	2	32	☌ ☽ ♄
24.	7	19	51	☌ ☽ ξ ♌
25.	12	40	39	☌ ☽ ϱ ♌
26.	16	41	47	☌ ☽ τ ♌
27.	4	28	30	☌ ☽ β ♍
27.	8	34	49	Em. III. sat. ♃
27.	19	51	5	☌ ☽ η ♍
28.	3	5	36	☽ First Quarter.
28.	7	32	48	☌ ☽ γ ♍
28.	22	30	41	☌ ☽ ϑ ♍
30.	0	48	3	Im. I. sat. ♃
30.	7	37	35	☌ ☽ κ ♍

On the 22d of May, there wlil be an Occultation of *Aldebaran* by the Moon:

	D.	H.	′	″	
Immersion, ...	22.	18	42	16,	at 184°
Emersion, ...	...	19	13	8,	at 258°.

The *angle* denotes the point of the Moon's limb where the phenomenon will take place, reckoning from the *vertex* of the limb towards the right hand round the circumference, as seen with a telescope which inverts.

The following Occultations were observed at the Observatory, Marischall College:

1829, D.		*Mean Time.* H.	′	″
Aug. 21.	γ Tauri, Emers.	22	43	33,4
22.	θ Tauri, Emers.	2	29	41,0
	75 Tauri, Emers.	2	37	49,0
	160 Mayer, Emers.	3	45	51,3
	Aldebaran, Immers.	5	36	14,6

D.		*Mean Time.* H.	′	″
Dec. 9.	Aldebaran, Immer.	17	46	29,1
	Emers.	18	37	44,8

Immersion instantaneous.

At Emersion, the star was 0′,2 in recovering its full splendour.

The Telescope used was a 3½ feet achromatic by Dollond. The observations have been corrected for the error and rate of the clock, which were obtained by transits of the sun and stars.

Times of the Planets passing the Meridian, and their Declinations.

APRIL.

	Mercury.		Venus.		Mars.		Jupiter.		Saturn.		Georgian.	
D.	H. ′	° ′	H. ′	° ′	H. ′	° ′	H. ′	° ′	H. ′	° ′	H. ′	° ′
1	10 55	5 25 S.	10 1	3 30 S.	7 4	22 18 S.	6 34	22 25 S.	20 17	18 27 N.	8 14	18 26 S.
5	11 4	2 32 S.	9 49	3 56	7 0	21 55	6 20	22 23	20 1	18 28	7 59	18 23
10	11 16	1 14 N.	9 37	4 8	6 54	21 23	6 3	22 20	19 41	18 28	7 40	18 21
15	11 31	5 32	9 27	4 1	6 48	20 47	5 44	22 18	19 22	18 28	7 20	18 19
20	11 48	10 3	9 20	3 36	6 42	20 8	5 25	22 16	19 2	18 27	7 1	18 18
25	12 12	14 27	9 14	2 53	6 36	19 26	5 6	22 15	18 43	18 26	6 42	18 16

MAY.

	Mercury.		Venus.		Mars.		Jupiter.		Saturn.		Georgian.	
D.	H. ′	° ′	H. ′	° ′	H. ′	° ′	H. ′	° ′	H. ′	° ′	H. ′	° ′
1	12 38	19 12 N.	9 9	1 44 S.	6 29	18 32 S.	4 43	22 15 S.	18 20	18 23 N.	6 19	18 15 S.
5	12 54	21 42	9 6	0 48 S.	6 23	17 54	4 28	22 15	18 4	18 20	6 3	18 15
10	13 12	23 54	9 4	0 32 N.	6 16	17 4	4 8	22 16	17 46	18 16	5 43	18 15
15	13 25	25 2	9 1	1 59	6 9	16 13	3 48	22 18	17 27	18 12	5 24	18 15
20	13 31	25 22	9 0	3 36	6 2	15 19	3 27	22 20	17 9	18 7	5 5	18 15
25	13 30	24 59	8 59	5	5 55	14 26	3 6	22 22	16 50	18 0	4 44	18 16

JUNE.

	Mercury.		Venus.		Mars.		Jupiter.		Saturn.		Georgian.	
D.	H. ′	° ′	H. ′	° ′	H. ′	° ′	H. ′	° ′	H. ′	° ′	H. ′	° ′
1	13 16	23 37 N.	8 59	7 39 N.	5 44	13 10 S.	2 37	22 27 S.	16 25	17 51 N.	4 16	18 17 S.
5	13 0	22 34	8 59	9 2	5 37	12 26	2 20	22 30	16 10	17 46	4 0	18 18
10	12 33	21 7	9 0	10 47	5 29	11 31	1 58	22 34	15 52	17 38	3 40	18 20
15	12 3	19 47	9 1	12 29	5 21	10 38	1 36	22 39	15 35	17 30	3 20	18 22
20	11 38	18 51	9 3	14 9	5 11	9 46	1 14	22 43	15 17	17 21	3 0	18 24
25	11 10	18 30	9 6	15 43	5 2	8 57	0 51	22 48	14 59	17 12	2 40	18 26

Proceedings of the Wernerian Natural History Society.

(Continued from p. 189.)

1830, *Jan.* 9.—**Robert Jameson**, Esq. President, in the chair. The Secretary read a communication by Dr R. K. Greville, on the various economical uses of sea-plants; and the Doctor exhibited beautiful dried specimens of the most useful and interesting species.—The Rev. Dr David Scot of Corstorphine then read an essay on the Rams and Badgers with the skins of which the Israelites covered the Tabernacle.—Specimens, male and female, of a rare North American Moth (Saturnia Luna), bred in Europe by M. Sömmer of Altona, from imported eggs, were exhibited; and illustrative notes, by Mr James Wilson, were read to the meeting. (See *supra*, p. 367.)

At this meeting, Dr **John Coldstream** of Leith, was admitted an ordinary member; **James Mather**, Esq. of South Shields, a non-resident member; M. **Chauvin** of Caen, a foreign member; and Dr **Holmes** of Montreal, a corresponding member of the society.

Jan. 23.—**David Falconar**, Esq. Vice-President, in the chair. —There were read to the meeting some notices relative to the coal found under the marly red sandstone near Leicester, contained in a letter to Henry Witham, Esq., illustrated by sections of the borings for coal.—Dr John Aitken then exhibited a number of very fine anatomical preparations, and gave from them a demonstration of the circulation of the blood in the fœtus, in man, and in several of the lower animals, particularly the cow, the red deer, the dog, and the seal.

The members of the society afterwards proceeded to Dr Hope's laboratory, to witness a beautiful experiment, showing the intense light and heat produced by passing upon an ignited ball of lime, placed in the focus of a light-house reflector, a continued stream of hydrogen gas.

Feb. 6.—**David Falconar**, Esq. V. P. in the chair.— The Secretary read a memoir by Mark Watt, Esq., on the power which certain spiders possess of fixing their threads horizontally between two perpendicular bodies placed at a distance from each other. Likewise, a notice regarding a sort of fascination practised on small birds by the whitret or weazel; in a letter from the Rev. Alexander Duncan of Mid-Calder.—The Rev. Dr Scot then read an essay on the Dishong of Moses or Gazelle of the Plain, the pygarg of the English Bible.

1830, *Feb.* 20.—DAVID FALCONAR, Esq. V. P. in the chair. —There was read an account of several new species of grouse recently discovered by Mr David Douglas among the Rocky Mountains, communicated by James Wilson, Esq.; the specimens at the same time being placed on the table. For a full description of these species, see p. 372 of this Number.—The Rev. Dr Scot read an essay on the mustard plant mentioned in the Gospels, showing that it was probably the Sinapis nigra, which grows five or six feet high in warm countries, rather than the Phytolacca decandra, which probably did not exist in Judea.

SCIENTIFIC INTELLIGENCE.

METEOROLOGY.

1. *Climate of Britain.*—Of all the climates of Europe, England seems to me most fitted for the activity of the mind, and the least suited to repose. The alternations of a climate so various and rapid, continually awake new sensations; and the changes of the sky from dryness to moisture, from the blue ethereal to cloudiness and fogs, seem to keep the nervous system in a constant state of disturbance. In the mild climate of Nice, Naples, or Sicily, where, even in winter, it is possible to enjoy the warmth of the sunshine in the open air under palm trees, or amidst evergreen groves of orange trees, covered with odorous fruit and sweet-scented leaves, mere existence is a pleasure; even the pains of disease are sometimes forgotten amidst the

balmy influence of nature; and a series of agreeable and uninterrupted sensations invite to repose and oblivion. But in the changeable and tumultuous atmosphere of England, to be tranquil is a labour, and employment is necessary to ward off the attacks of ennui. The English, as a nation, is pre-eminently active, and the natives of no other country follow their objects with so much force, fire, and constancy. And, as human powers are limited, there are few examples of very distinguished men living in this country to old age. They usually fail, droop, and die, before they have attained the period naturally marked for the end of human existence. The lives of our statesmen, warriors, poets, and even philosophers, afford abundant proofs of the truth of this opinion; whatever burns consumes, ashes remain. Before the period of youth is passed, grey hairs usually cover those brows which are adorned with the civic oak or laurel; and in the luxurious and exciting life of the man of pleasure, their tints are not even preserved by the myrtle wreath, or the garland of roses, from the premature winter of time.—*Sir H. Davy.*

2. *Winter of* 1829-30.—It appears that the cold in the south of France and in Spain has long prevailed, and been more severe than has been experienced there for a great number of years; but that in this country (Scotland), and in places in a higher northern latitude, although they have had very deep snow, yet it has been found comparatively mild for a winter like this; therefore, the rigour of the frosty air seems to have been confined within the parallels of 55° and 38° N. Lat. with prevailing N. and N.E. winds from over the continent of Europe. Ireland being within these parallels, it is curious that its inhabitants should, at the same time, also have enjoyed a mild atmosphere.—*Annals of Philosophy,* March 1830.

3. *Meteorological Table.*—Extracted from the Register kept at Kinfauns Castle, N. Britain. Lat. 56° 23′ 30″; above the level of the sea 150 feet. (Communicated by Lord Gray.)

1829,	Morning, ¼ past 9, *Mean Height of*		Evening, ½ past 8, *Mean Height of*		Mean Temp. by Six's Therm.	Depth of Rain in Garden.	No. of Days	
	Barom.	Therm.	Barom.	Therm.			Rain or Snow.	Fair.
	Inches.	°	Inches.	°	°	Inches.		
January, ...	29.750	34.774	29.774	33.742	35.129	5.00	10	21
February, ...	29.499	39.607	29.715	40.000	40.321	2.00	7	21
March, ...	29.720	41.387	29.714	40.581	41.645	1.50	7	24
April, ...	29.318	44.800	29.357	42.533	43.767	3.00	15	15
May, ...	29.811	54.326	29.829	50.161	52.258	1.70	7	24
June, ...	29.792	60.600	29.782	55.500	58.067	1.80	13	17
July, ...	29.512	60.258	29.520	55.774	58.193	5.85	16	15
August, ...	29.622	58.064	29.637	54.838	56.387	5.40	14	17
September, ...	29.487	52.133	29.492	49.733	51.133	2.75	11	19
October, ...	29.744	48.419	29.743	47.003	47.903	2.50	13	18
November, ...	29.789	41.467	29.826	41.066	41.366	2.80	11	19
December, ...	29.955	39.194	29.961	37.645	38.710	1.30	7	24
Average of the year,	29.667	47.919	29.696	45.634	47.073	35.60	131	234

ANNUAL RESULTS.

MORNING.

	BAROMETER.			THERMOMETER.		
Observations.		Wind.	Inch.		Wind.	
Highest, .	31st Dec.	SW.	30.50	31st August, ...	SW.	67°
Lowest, .	15th April,	SE.	28.53	22d January, ...	SW.	21°

EVENING.

Highest, .	31st Dec.	SW.	30.56	8th August, ...	SW.	64°
Lowest, .	15th April,	SE.	28.63	19th January, . . .	W.	26°

Weather.	Days.
Fair, ...	234
Rain or snow, ...	131
	365

Wind.	Times.
N. & NE.	19
E. & SE.	101
S. & SW.	201
W. & NW.	44
	365

Extreme Heat and Cold by Six's Thermometer:

Coldest, 22d January, . .	Wind, SW. .	19°
Hottest, 11th June, . .	do. SE. .	74°

Mean Temperature for the year, 47°.073

Results of Two Rain-Gauges.

	In. 100.
1. Centre of Kinfauns Garden, about 20 feet above the level of the sea,	35.60
2. Square Tower, Kinfauns Castle, 180 feet, ...	36.00

4. ***Meteorological Tables for Aberdeen,* 1829.**—As in a contemporary Journal, that of Dr Brewster, there is an accurate Meteorological Table for Edinburgh, by Mr Adie, we do not consider it necessary to republish it here, but are happy to have an opportunity of communicating to our readers accurate Meteorological Tables of another well known part in Scotland, viz. Aberdeen, drawn up by Mr Innes of Aberdeen.

TABLE *of the Mean Temperature at Aberdeen for each Month of the last Seven Years.*

From Observations made by Mr George Innes, Astronomical Calculator.

	1823.	1824.	1825.	1826.	1827.	1828.	1829.
January,....	36.69	40.14	37.95	34.29	35.43	40.00	34.40
February,...	35.03	38.32	37.54	40.59	34.91	41.43	38.69
March, ...	40.41	36.69	39.88	40.04	39.06	42.87	41.60
April,.........	44.56	44.13	44.42	45.32	45.17	45.57	43.25
May,.........	51.33	48.73	48.50	63.27	50.98	52.07	51.85
June,.........	54.19	54.76	56.10	62.65	57.45	58.95	56.43
July,.........	56.24	60.51	60.50	51.48	62.05	60.55	58.56
August,......	56.88	58.63	59.83	60.34	57.49	60.39	56.49
September, .	54.08	53.47	57.56	55.25	56.34	55.94	51.57
October,......	48.27	45.47	50.45	49.56	51.88	48.74	46.45
November,..	47.81	38.89	40.14	38.41	41.59	46.18	41.01
December, ..	39.94	36.13	39.37	40.23	41.89	43.15	39.14
Mean,...	47.12	46.32	47.69	48.45	47.85	49.65	46.62

MEAN OF THERMOMETER,

At Aberdeen, for each Month during the Year 1829.

January,..............................	34.40
February,............................	38.69
March,................................	41.60
April, ...	43.25
May, ...	51.85
June,..................................	56.43
July, ...	58.56
August,..............................	56.49
September,.........................	51.57
October, ...	46.45
November,.........................	41.01
December, ...	39.14
Mean Temp. of the Year,.....	46.62

RAIN

Fallen at Marischal College Observatory, Aberdeen, during the Year 1829.

January,...................	3.48 Inches.
February,.................	0.99
March,.....................	3.12
April,.......................	2.74
May,........................	0.66
June,.......................	1.54
July,........................	1.92
August,*..................	4.35
September,..............	2.35
October, ...	2.72
November, ...	2.34
December,...............	2.45
Total,................	28.66 Inches.

* The quantity which fell during the flood of the 2d, 3d, and 4th of August, was 1.80 inch.

5. *Latitude of Calton Hill.*—As the Calton Hill is one of our most interesting meteorological and geological points, we are happy in having an opportunity of giving the precise position of the Observatory placed upon it. The Latitude of this Observatory, as determined by Mr Henderson, from the data of the Trigonometrical Survey, is 55° 57′ 19″ 5 N.

6. *Mysterious Sounds.*—The wide spread sail of a ship, rendered concave by a gentle breeze, is a good collector of sound. "It happened," says Dr Arnott, "once on board a ship sailing along the coast of Brazil, far out of sight of land, that the persons walking on deck, when passing a particular spot, always heard very distinctly the sound of bells, varying as in human rejoicings. All on board came to listen, and were convinced; but the phenomenon was most mysterious. Months afterwards, it was ascertained, that, at the time of observation, the bells of the city of St Salvador, on the Brazilian coast, had been ringing on the occasion of a festival; their sound, therefore, favoured by a gentle wind, had travelled perhaps 100 miles by smooth water, and had been brought to a focus by the sail on the particular situation or deep where it was listened to. It appears from this, that a machine might be constructed, having the same relation to sound that a telescope has to sight.

7. *Effects of Electricity on Rocks.*—Electricity, as a chemical agent, may be considered, not only as directly producing an infinite variety of changes, but also as influencing almost all which take place. There are not two substances on the surface of the globe, that are not in different electrical relations to each other; and chemical attraction itself seems to be a peculiar form of the exhibition of electric attraction; and, whereever the atmosphere, or water, or any part of the surface of the earth, gains accumulated electricity of a different kind from the contiguous surfaces, the tendency of this electricity is to produce new arrangements of the parts of these surfaces. Thus, a positively electrified cloud, acting even at a great distance on a moistened stone, tends to attract its oxygenous, or acidiform, or acid ingredients, and a negatively electrified cloud, has the same effect upon its earthy, alkaline, or metallic matter; and the silent and slow operation of electricity is much more important

in economy of nature, than its grand and impressive operation in lightning and thunder.

8. *Meteoric Iron of Atacama.*—In the lately published part of the Transactions of the Royal Society of Edinburgh, there is an analysis of this iron by Dr Turner, which is not correctly given. Dr Turner sends the following as the accurate result. Iron, 93.57; Nickel, 6.618; Cobalt, 0.535; =100.723.

MINERALOGY.

9. *Perishable Nature of Works of Man.*—No work of excellence ought to be exposed to the atmosphere; and it is a great object to preserve them in apartments of equable temperature, and extremely dry. The roofs of magnificent buildings should be of materials not likely to be dissolved by water, or changed by the air. Many electrical conductors should be placed so as to prevent the slow or the rapid effects of atmospheric electricity. In painting, lapis lazuli, or coloured hard glasses, in which the oxides are not liable to change, should be used, and should be laid on marble, or stucco encased in stone; and no animal or vegetable substances, except pure carbonaceous matter, should be used in pigments; and none should be mixed with the varnishes. Yet, when all is done that can be done, in the work of conservation, it is only producing a difference in the degree of duration. And from the statements that our friend has made, it is evident that none of the works of a mortal being can be eternal, as none of the combinations of a limited intellect can be infinite. The operations of Nature, when slow, are no less sure. However man may for a time usurp dominion over her, she is certain of recovering her empire. He converts her rocks, her stones, her trees, into forms of palaces, houses, and ships; he employs the metals found in the bosom of the earth as instruments of power—and the sands and clays which constitute its surface, as ornaments and resources of luxury; he imprisons air by water, and tortures water by fire, to change, or modify, or destroy, the natural forms of things. But, in some lustrums, his works begin to change, and in a few centuries they decay and are in ruins; and his mighty temples, framed, as it were, for immortal and divine purposes—and his bridges formed of granite, and ribbed of iron—and his walls for

defence, and the splendid monuments by which he has endeavoured to give eternity even to his perishable remains, are gradually destroyed; and those structures which have resisted the waves of the ocean, the tempests of the sky, and the stroke of lightning, shall yield to the operation of the dews of heaven, of frost, rain, vapour, and imperceptible atmospheric influences; and as the worm devours the lineaments of his mortal beauty, so the lichens and moss, and the most insignificant plants, shall feed upon his columns and his pyramids, and the most humble and insignificant insects shall undermine and sap the foundations of his colossal works, and make their habitations amongst the ruins of his palaces and the falling seats of his earthly glory.

GEOLOGY.

10. *Norway has not been materially elevated above the level of the sea for the last* 800 *years.*—The history of the small island of Munkholm, on the coast of Norway, is interesting, as connected with a well known speculation, namely, that which maintains that the land of Scandinavia is gradually rising above the level of the sea, through the agency of some subterranean power. M. Everest says, " The history of this small isle weighs strongly against the rise of Scandinavia, as a general proposition. Its area is not greater than that of a small village, and, by the official survey, its highest point is said to be 23 feet above the mean high-water-mark (that is, the mean between neap and spring tides). An extreme spring tide may rise 3 feet higher, thus leaving 20 feet for the highest point. But the Swedish rate of rise is stated at 40 inches in a century. Now, A. D. 1028, or 800 years ago, a monastery was founded there by Canute the Great; and, in 995 (33 years before that time), it was in use as a common place of execution, and the famous Hagen Hlade Jarl's head was nailed to a gibbet there. Take the first of these periods, 1028; then, 40 × 8 = 320 inches, or 26 feet 8 inches; so that this rock must then have been below high-water-mark, according to this supposition. It is not likely that, in such a state, it would have been chosen as the site of a building."—*Everest's Travels through Norway.*

11. *Fossil Insects in lower Oolite, at Solenhof.*—In the cabinet of the Royal Academy of Munich, there are many speci-

mens of fossil insects, found in the oolite limestone of Solenhof. The following are mentioned by Wagner. Thirty species, many undescribed, of the class Crustacea; several species of the genera Æschna, Agrion, Myrmeleon; so that, at the time of the deposition of this limestone, there lived at least three genera of Hymenopterous insects. A fossil Sirix, in the collection, may be considered as the representative at that period of the order Neuroptera. Von Schlotheim mentions an impression in this limestone of an insect, which he conjectures to be nearly allied to the moth named Sphinx ligustri; and also a fossil beetle, allied to the genus Cerambyx. The Spider class appears to have existed also at this time, as is shewn by a fossil nearly allied to the Solpuga Fabr Galeodes of Olivier.

12. *Antique Green Porphyry.*—In the Island of Ægina, one of the Greek Islands, Captain Boblaye, a French engineer, discovered rocks of antique green porphyry (ophite), which he refers to the porphyries of the coal formation.

13. *Durability of Stones.*—When the felspar of the granite rocks contains little alkali, or calcareous earth, it is a very permanent stone; but when in granite, porphyry, or syenite, either the felspar contains much alkaline matter, or the mica, schorl, or hornblende, much protoxide of iron, the action of water containing oxygen and carbonic acid on the ferruginous elements tends to produce the disintegration of the stone. The red granite, black syenite, and red porphyry of Egypt, which are seen at Rome in obelisks, columns, and sarcophagi, are amongst the most durable compound stones; but the grey granites of Corsica and Elba are extremely liable to undergo alteration: the felspar contains much alkaline matter, and the mica and schorl much protoxide of iron. A remarkable instance of the decay of granite may be seen in the hanging tower of Pisa; whilst the marble pillars in the basement remain scarcely altered, the granite ones have lost a considerable portion of their surface, which falls off continually in scales, and exhibits everywhere stains from the formation of peroxide of iron. The kaolin, or clay, used in most countries for the manufacture of fine porcelain or china, is generally produced from the felspar of decomposing granite, in which the cause of decay is the dissolution and separation of the alkaline ingredients. Water is capable of dissolving, in

larger or smaller proportions, most compound bodies; and the calcareous and alkaline elements of stones are particularly liable to this kind of operation. When water holds in solution carbonic acid, which is always the case when it is precipitated from the atmosphere, its power of dissolving carbonate of lime is very much increased; and, in the neighbourhood of great cities, where the atmosphere contains a large proportion of this principle, the solvent powers of rain upon the marble exposed to it must be greatest. Whoever examines the marble statues in the British Museum, which have been removed from the exterior of the Parthenon, will be convinced that they have suffered from this agency; and an effect so distinct in the pure atmosphere and temperate climate of Athens, must be on a higher scale in the vicinity of other great European cities, where the consumption of fuel produces carbonic acid in large quantities.

BOTANY.

14. *On Columba Root.*—Columba Root has long been a well known article of the Materia Medica, and esteemed a valuable medicine for rectifying the tone of the stomach and alimentary canal, when injured by such diseases as cholera and dysentery. The plant grows in the countries of Mozambique and Querimba on the east coast of Africa. The authorities at the Portuguese settlements there have endeavoured to preserve to themselves a monopoly of the medicine, and they long succeeded in doing so. In the year 1805, however, a single plant was brought alive to Madras by M. Fortin. This specimen grew and flowered there, and was described by Dr Andrew Berry, then of the Medical Board of Fort St George, now of Edinburgh. It proved a diœcious plant; and Dr Berry correctly remarked, that it was closely allied to the genus Menispermum. The individual growing at Madras was a male. Willdenow and Sprengel inserted the plant in their systems under the name of Menispermun palmatum. Sir J. E. Smith, in Rees' Cyclopœdia, conjectured that it had been carried from Columbo, in Ceylon, to the East Indies, and had thus derived its name. This, however, was a mistake, it being known in Africa by the name of Kalumba. De Candolle afterwards determined that the plant properly belonged to the genus Cocculus, but regretted that he

had no means of describing the female flower or the seed. After the lapse of twenty years, an enterprising naval commander, who was fond of botany (Captain Owen), happened to be stationed in the Mozambique Channel, and of course had a good deal of intercourse with the natives on the coast. He succeeded in bringing away from the port of Oibo, many cases containing living plants of both sexes. Some of these were taken to Bombay, others to the Isle of France, and some to the Seychelles Islands. All the plants left at the Mauritius proved male; but females appeared among those at the Seychelles, and from thence some female plants were transmitted to the King's garden at the Isle of France; so that the multiplication of the plant by seed is now certain. Professor Bojer of the Mauritius has sent home drawings and descriptions of both sexes; and Professor Hooker of Glasgow has just published these in the Botanical Magazine, of which he is the able conductor. A tincture had been made from the roots of plants grown at the Mauritius, according to the formula of the London College: it was found to be stronger, and to have a more grateful and aromatic flavour, than that procured from Apothecaries' Hall. We are happy to add, that living plants have been sent to this country by Mr Telfair of the Isle of France, and have been received both by Mr Barclay of Buryhill and by the Glasgow Botanic Garden.

ZOOLOGY.

15. *Nature of Respiration.—My idea* is, that the common air inspired enters into the venous blood entire, in a state of dissolution, carrying with it its subtile and etherial part, which in ordinary cases of chemical change is given off; that it expels from the blood carbonic acid gas and azote; and that, in the course of the circulation, its etherial part and its ponderable part undergo changes which belong to laws that cannot be considered as chemical;—the etherial part probably producing animal heat and other effects, and the ponderable part contributing to form carbonic acid and other products. The arterial blood is necessary to all the functions of life, and it is no less connected with the irritability of the muscles and the sensibility of the nerves, than with the performance of all the secretions.—*Sir H. Davy.*

16. *Cuttle-fish Fishery.*—A curious account has been published by M. Pilaje, of the uncommon and important Cuttle-fish (Sepia) fishery on the coast of Newfoundland. It is the *Loligo piscatorum* of authors. It occurs in vast abundance, but at different times, on different coasts; for example, at St Pierre in July, on the southern coasts of Newfoundland only in August, and in Bonne Bay first in September. Its vast shoals present a curious appearance, by their strongly twisted compact form. When they approach, hundreds of vessels are ready for their capture. A cylindrical polished piece of lead, of which one end runs into a number of hooks, is used as a bait. When it occurs in great numbers, a person can take a thousand in the space of an hour. At this season of the year, the sea on the coast of St Pierre is covered with from 400 to 500 sail of English and French ships engaged in the Cuttle-fish fishery. The Cuttle-fish is sometimes eaten, but the proper object of their capture is the using them afterwards as bait in the taking of the cod and other fishes that afterwards appear on the coast. In Mr Cormack's paper in vol. i. p. 37, of Edinburgh New Philosophical Journal, the reader will find an interesting account of the Cuttle-fish as a bait in the cod-fishery of Newfoundland.

17. *Anatifera Vitrea or Vitreous Barnacle.*—This species, a native of the Mediterranean, is not, like the others, fixed, on the contrary, is a free pelagian molluscous animal. It suspends itself, like the Ianthina, at the surface of the water by means of white translucent air-vesicles. These vesicles are connected with the fleshy pedicle; by their means the animal floats freely on the surface of the water, but it can also sink itself at pleasure.

18. *Mortality among Leeches.*—That atmospheric changes have a remarkable influence upon leeches, is a well established fact. In 1825, M. Derheims of St Omer, ascribes the almost sudden death of them at the approach of, or during storms, to the coagulation of the blood of these creatures, caused by the impression of the atmospherical electricity. This opinion, which at that time was the result of theory, he confirmed, in the month of March last, by direct experiment.

19. *Belemnites.*—Raspail, who enumerates 250 species of this genus, maintains that they are not shells of animals, but cuta-

neous appendages of a marine animal, perhaps allied to the Echinodermata.

NEW PUBLICATIONS.

20. *A Concise System of Mathematics, in Theory and Practice, for the use of Schools, Private Students, and Practical Men.* By Alexander Ingram, Esq. Edinburgh.—We have carefully examined this valuable work, and find it throughout excellently calculated for the purposes stated in the title. The matter is well selected and judiciously arranged; the practical rules are given with great clearness, and the illustrations prove the thorough knowledge of the late excellent author, in all the practical details of this important branch of education. It is neatly and correctly printed, and, what we consider of importance in a work of this description, is remarkably cheap.

21. *An American Dictionary of the English Language*; by Noah Webster, LL.D. 2 vols. 4to. New York.—In this work, Dr Webster has exhausted the labour of a long life, and, in search of materials, visited the Royal Library at Paris, and the libraries of the English Universities. 'Of his etymological researches, I feel myself but imperfectly qualified to judge, my own studies having lain in a different department. I know, however, that he entered on these pursuits more than thirty years ago, with an ardent admiration of the writings of Horne Tooke; and that, extending his inquiries to the eastern dialects, which were unknown to that writer, he has gradually embraced more than twenty languages within the circle of his investigations, and made them all subservient to his researches into the origin and progress of our own. That these inquiries should present many things of doubtful probability, is of course to be expected. That many new relations between our own and other languages are pointed out, and that much light is thrown on the radical meaning of words, will, I presume, be obvious to all who take an interest in such discussions. The number of these, however, in this country at least, is comparatively few; and, to others, such inquiries will present a perfect blank, or will perhaps afford a fruitful theme for ridicule. This work, as a *defining* dictionary, I have been led, from the nature of my pursuits, to examine with close attention. I have even collated the greater part of its pages with Todd's edition of Johnson's

Dictionary. In this respect, the improvements appear to me to be numerous, and highly important. Many thousands of the most common senses of terms were either overlooked by Dr Johnson, or have found their way into the language since his time. In scarcely a single instance have these deficiencies been supplied by the English editors, or even the most glaring errors corrected. That the dictionaries of our language are fifty years behind the progress of knowledge among the English nation, as recorded in our books, is a fact conceded by every one who has taken the pains to examine the subject. Dr Webster, besides adding very largely to the number of definitions, has given to them, in a great degree, the precision of modern science; and although every attempt of this kind must, from the nature of the case, be liable to many imperfections, we cannot but think that he will be ultimately regarded as having carried forward English lexicography as much beyond the point where it was left by Johnson, as Johnson himself advanced it beyond the progress of *his* predecessors. Like most men who have long contemplated the irregularities of English *orthography*, Dr Webster has been too anxious, probably, to accelerate its slow progress towards *stricter* analogies. His alterations are not indeed very numerous; but supported as they are by general principles, and harmless as they are at all events, he will still undoubtedly be liable to the charge of "the affectation of spelling better than his neighbours." We were afraid that the real merits of this excellent work would be overlooked for a time. In this, however, we have been deceived, for a British edition of this American Dictionary is in the course of publication, which, we understand, will rival the splendid American edition.

22. *French edition of Berzelius's Chemistry condemned.*—Didot in Paris, says Berzelius, in a letter to Kastner, commenced a French translation of my book on Chemistry, which is announced as an entirely new edition. Unfortunately, however, the undertaking has misgiven. Jordan, the translator, a person unknown to me, is no chemist; hence the first volume, which has already appeared, teems with the grossest errors. At my request the second volume, which is even more wretchedly executed than the first, has not been published. What Didot will do in these circumstances I know not; but the translation of Jordan I shall never sanction.

List of Patents granted in England, from 15*th September to* 21*st November* 1829.

1829.

Sept. 15. To J. Aitchison, Clyde Buildings, Glasgow, for his "improvements in the Concentrating and Evaporating of Cane Juice, Solutions of Sugar, and other Fluids."

To T. Cobb, Calthorpe House, Bradbury, Oxford, for his "improvements in the manufacture of Paper, intended for the walls of rooms, and in the apparatus for effecting the same."

23. To T. Westwood, Middlesex, watchmaker, for his "improvements in Watches and Time-keepers."

To J. Brown, Clerkenwell, watchmaker, for his "improvements applicable to Watches and other Horological Machines."

To H. Tyler, Warwick Lane, brass-founder, for his "improvements in the construction of Water-closets."

30. To J. Moore, Bristol, for "Machinery for propelling carriages, ships, or other floating bodies; and Apparatus for condensing the steam of the steam-engine, after it has propelled the steam-engine piston."

To Lieutenant M. Rodger, Royal Navy, Strand, London, for his "improvements in the construction of Cat-head Stoppers."

To T. Banks, Patrecroft, civil engineer, for his "improvements in Steam-engines."

Oct. 7. To P. Descroizilles, Fenchurch Street, London, for his "improvements in Apparatus for removing the down from cotton and certain other fabrics, by singeing."

15. To W. Church, Heywood House, near Birmingham, for "improvements in Machinery for propelling vessels by steam, and in Boilers applicable to the same, and also to other purposes."

To W. Church, Heywood House, near Birmingham, for his "improvements in, on, or upon Instruments for sharpening knives and other edge-tools, and the Machinery or Apparatus for manufacturing the same."

28. To T. J. Fuller, civil engineer, Middlesex, for his "improved Mechanical Power, applicable to machinery of different kinds."

Nov. 2. To G. Danre, Birmingham, for his "Self-acting Air or Gas Regulator or Stopcock, for governing the flow of air or gas, which may be applied to other purposes."

To J. MacCurdy, Esq. Great James' Street, Bedford Row, London, for "improvements in the method of constructing Mills and Mill-stones for grinding."

To Colonel J. Viney, Piccadilly, for "improvements in Steam-boilers, and in carriages or apparatus connected therewith."

To J. Soams *junior*, Spittalfields, soap-maker, for his "preparation of a certain material produced from a vegetable substance, and the application thereof to the purposes of affording Light, and other uses."

1829.

Nov. 2. To J. Tucker, Hammersmith, brewer, for his "Exploding Shot or Projectile."

To J. Stewart, George Street, Euston Square, for his "improvements in Piano-fortes."

To J. Cowderoy, Esq. City Road, for his "improvements in the machinery for making Bricks."

To F. Naish Stoneason, Esq. Wells, Somerset, for his "improvements in the manufacture or application of Silks, mixed or combined with other articles."

7. To W. Gooch, London, for his "improvements in Baths of different descriptions."

10. To D. Macdougal, Edinburgh, horticulturist, for his "improvements on Syringes, applicable to gardens and other purposes."

To J. Ostler, Birmingham, for "improvements in the construction of Glass and Metal Chandeliers, and other articles for ornamental lighting."

12. To P. Gibbs, Crayford Mills, Kent, for "improvements in machinery for Cutting Marble, Wood, and other substances."

17. To J. W. Dodgson, Middlesex, for his "improvements in Ships' Scuppers, and which may be applied to other purposes."

21. To T. Gethen, Esq. Furnival's Inn, London, for "improvements in Dressing Woollen Cloths."

To W. Clutterbuck, Gloucester, for "improvement in the Shears used for cutting or cropping of Woollen Cloth, and other fabrics requiring shearing."

List of Patents granted in Scotland from 17*th December* 1829 *to* 3*d March* 1830.

1829.

Dec. 17. To Charles Brook of Meltham Mills, near Huddersfield, in the county of York, cotton-spinner, for an invention of "certain Improvements in Machinery for Spinning Cotton, and other fibrous substances."

17. To James Soames junior, of Wheeler Street, Spittalfields, in the county of Middlesex, for an invention of "a New Preparation or Manufacture of a certain Material produced from a Vegetable Substance, and the application thereof to the purposes of affording light, and for other Uses."

1830.

Jan. 25. To John Tucker of Hammersmith, in the county of Middlesex, brewer, for an invention of "an Exploding Shot or Projectile."

Feb. 2. To John Revere of New York, in the United States of America, now residing in the parish of St James, Westminster, Doctor of

Medicine, for an invention of "a New Alloy, or Compound Metal, applicable to the Sheathing of Ships, and various other useful purposes."

1830.

Feb. 2. To **Edward Dakeyne** and **James Dakeyne**, both of Derby Dale, in the county of Derby, merchants, for an invention of "a Machine or Hydraulic Engine, for applying the power or pressure of Water, Steam, or other Elastic Fluids, to the purpose of working Machinery, and other uses requiring power, and applicable to that of Raising or Forcing Fluids."

8. To **George Straker**, of South Shields, in the county of Durham, ship-builder, for an invention of "an improvement in Ships Windlasses."

9. To **James Ramsay** and **Andrew Ramsay**, both of Greenock, in North Britain, cordage and sail-cloth manufacturers, and **Mathew Orr** of Greenock foresaid, sailmaker, for "an Improvement in the Manufacture of Canvas, and Sail-cloth for the making of Sails."

13. To **Thomas John Fuller** of the Commercial Road, Limehouse, in the county of Middlesex, Civil Engineer, for an invention of "an improved Mechanical Power applicable to Machinery of different descriptions."

16. To **Ayton Bernhard** of Finsbury Circus, in the county of Middlesex, engineer, for an invention of "Certain Improvements on or additions to, Wheels or Apparatus for propelling Vessels, and other purposes."

19. To **John Braithwaite** and **John Erisson** of the New Road, London, for an invention of "an Improved Method of Manufacturing Salt."

26. To **Patrick Dawson**, distiller at Lillyburne, for an invention of "an Improvement in the Apparatus used for Distilling."

To **Robert Busk** of Leeds, in the county of York, gentleman, for an invention, in consequence of a communication made to him by a certain foreigner, residing abroad, "of certain Improvements in Apparatus used for Distilling and Rectifying."

Mar. 3. To **John M'Innes** of Auchenreoch and of Woodburn, in the county of Stirling, Esq. for an invention of "the Manufacture or Preparation of certain substances, which he denominates the British Tapioca, and the Cakes and the Flour to be made from the same."

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EXPLANATION OF PLATES.

Plate I.—Holothuria tubulosa or Tripang, 46.

Fig. 1. The Tripang or Holothuria laid open. The transparent oblong bodies are represented at *a*. The lighter parts of the intestine are those containing fluid. The lung is seen at *b*.

Fig. 2. Is the sac, after the removal of the organs; shewing the calcareous ring of the mouth, the transverse fibres and longitudinal bands, and the membrane, extended across the posterior extremity, which forms (and has been termed) the cloaca.

Fig. 3. Is a view of the groups of vessels which, issuing from the lung, form one vessel, which divides immediately into many small branches, to be distributed to the contiguous intestine. On the outer surface of the intestine is seen a vessel, which may be traced to the anus, where it joins the pulmonary vein.

Fig. 4. A tentaculum *.

Plate II.—Geognostic Map of the Territory of Rome, p. 76.
III.—Hart's economical apparatus for heating apartments, p. 172.
IV.—Chart of Professor Kupfer's Isogeothermal lines.
V.—Illustrative of Captain Wauchope's Signal-post for regulating Chronometers, p. 289.
VI.—Nepenthes distillatoria or Pitcher-plant of China, its seeds, and mode of germination, p. 379.

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* The Editor regrets that part of the interesting drawings illustrative of the Tripang have been lost in a quarter in London, where they had been deposited some time by the author. Mr Collier has again sailed for India, and promises to transmit to us without delay a further account of those animals, so important in a commercial point of view.

NEILL & CO. PRINTERS.

Fig. 4.

Tripang.

Fig. 1.

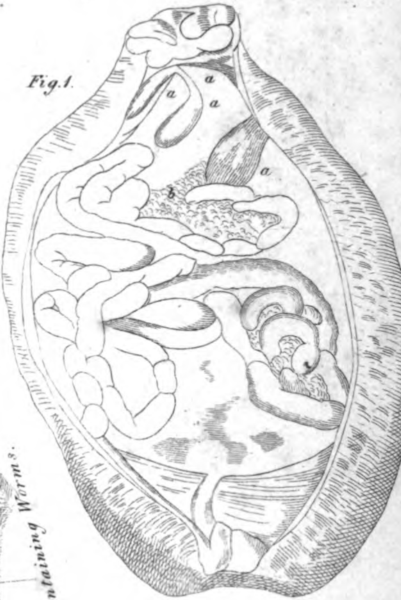
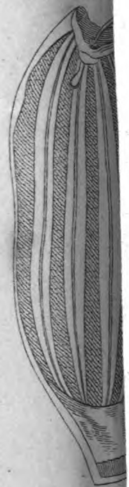
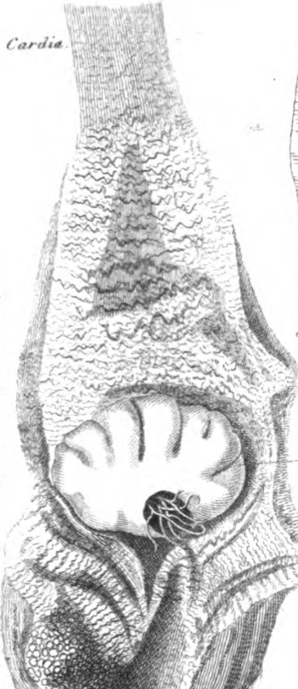


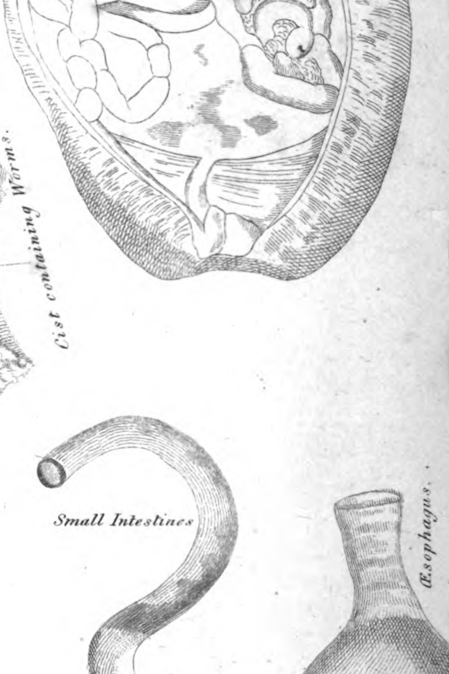
Fig. 3

Fig. 2



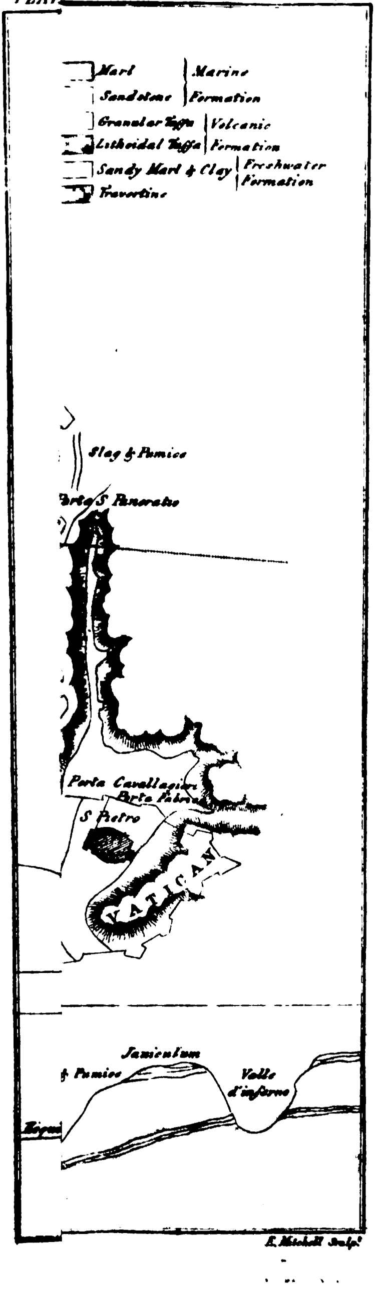


Interior View of the Stomach of Manis pentadactyla.



External Veiw of Stomach of Manis pentadactyla.

PLAT Edin.r new Phil. Jour. Vol. 8 p. 73.



E. Mitchell Sculp.t

PLATE III

Edin.r new Phil. Jour.r Vol. 8. p.204.

Fig 2

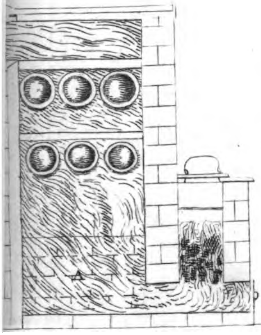


Fig 1

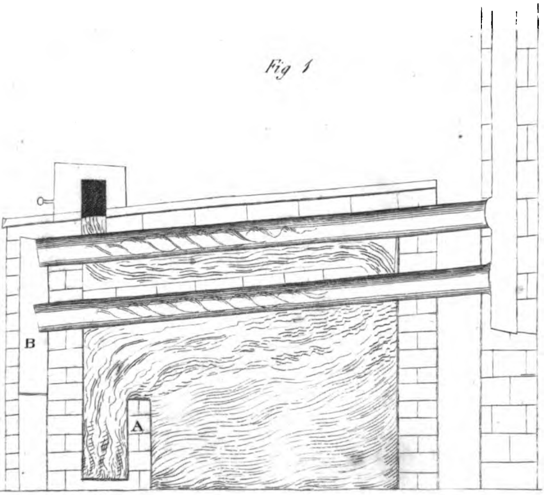


Fig 3

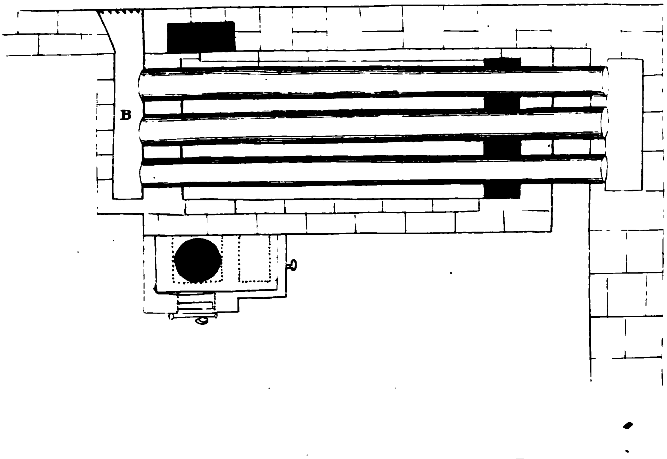


Fig. 4.

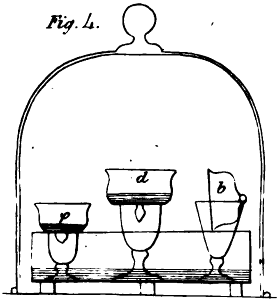
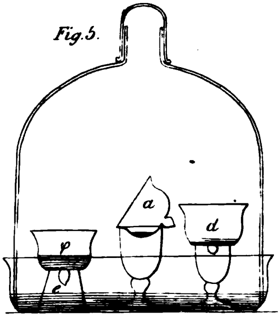


Fig. 5.



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E.Mitchell sculpt.

PLATE IV.

CHART of the ISOGEOTHERMAL LINES of EUROPE & part of AMERICA; by PROFESSOR A. T. KUPFFER.

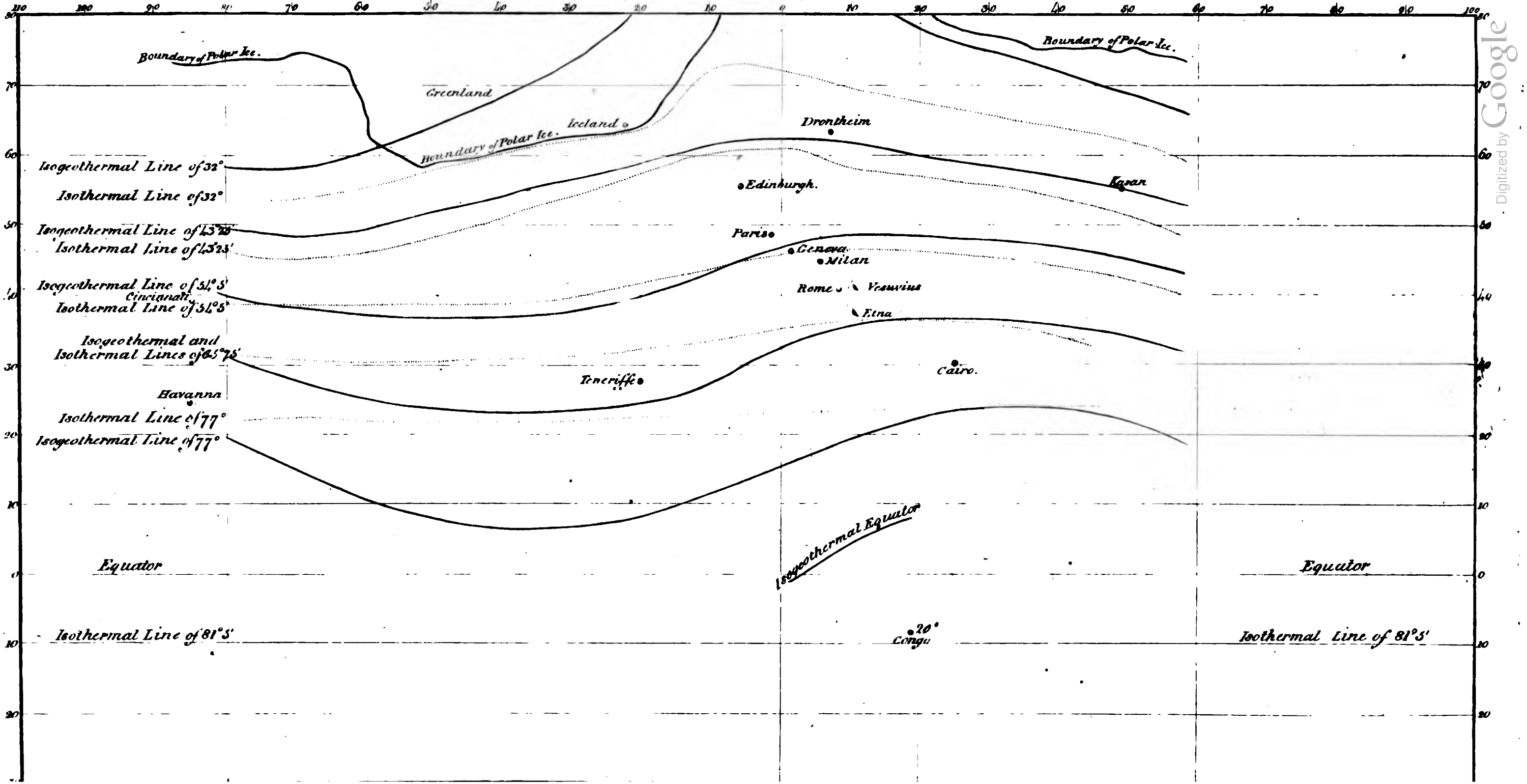
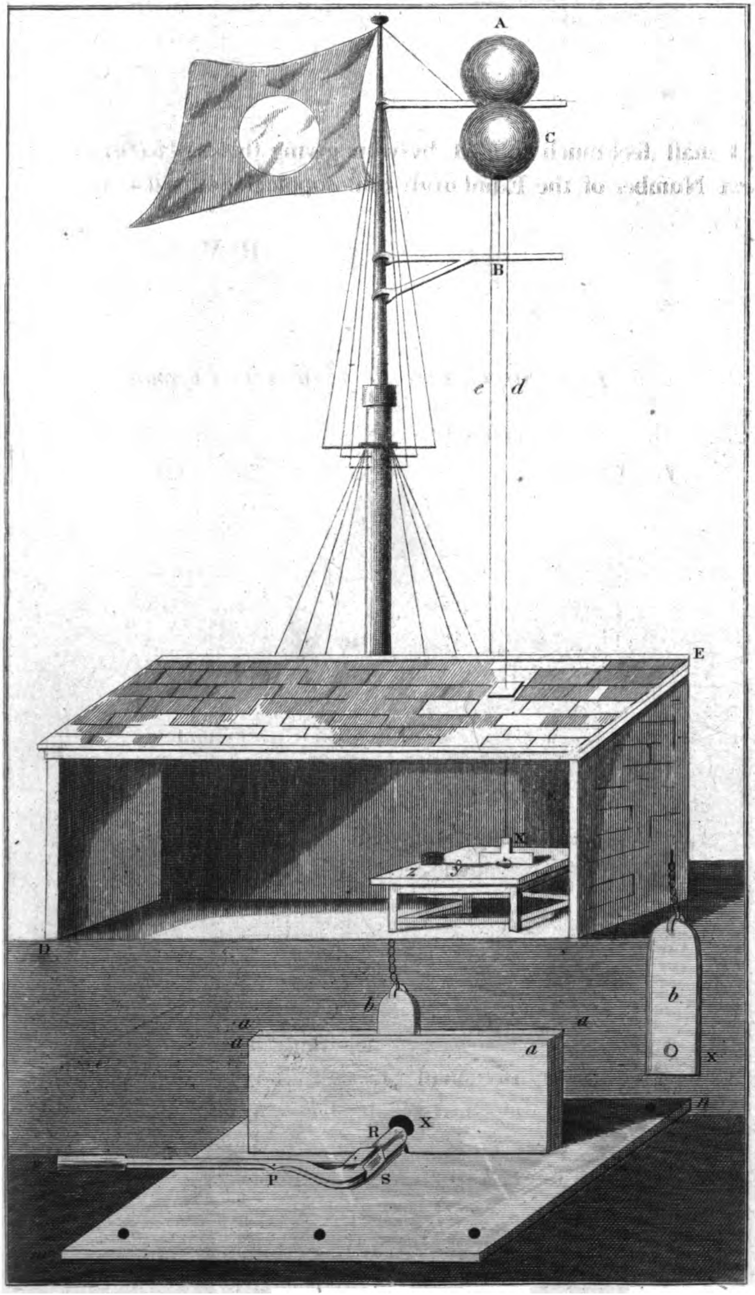


PLATE V. *Edinr. new Phil. Jour. Vol. 8 p. 290.*



Published by A. Black Edinr. 1830. *E. Mitchell Sculp.*

DISTILLATORIA